

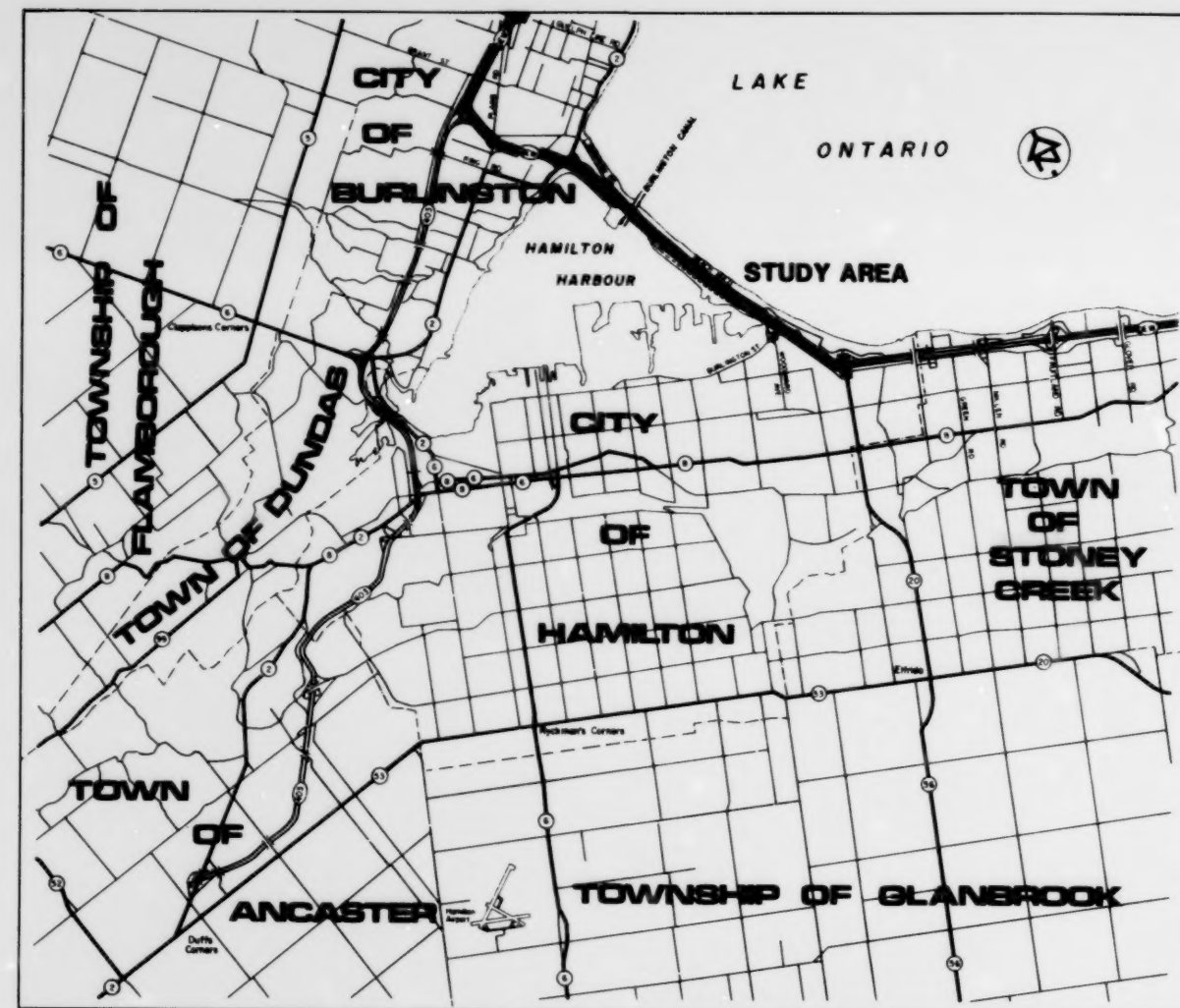
Burlington Skyway Freeway Traffic Management System Queen Elizabeth Way

from
GUELPH LINE
to
HIGHWAY 20

W. P. 85-81-00

CITY of HAMILTON
CITY of BURLINGTON
REGIONAL MUNICIPALITY of HAMILTON WENTWORTH
REGIONAL MUNICIPALITY of HALTON

PRELIMINARY DESIGN REPORT



KEY PLAN

J. W. SNOW
MINISTER

H. F. GILBERT
DEPUTY MINISTER

M. KELCH
EXECUTIVE DIRECTOR
HIGHWAY OPERATIONS AND
MAINTENANCE DIVISION

M. HARMELINK
MANAGER, TRAFFIC MANAGEMENT
AND ENGINEERING OFFICE

FEBRUARY 1984

Prepared by
IBI GROUP

[Signature]
H. WONG
Project Engineer

Approved by
[Signature]
C. A. RAYMAN
Head, Freeway Traffic
Management Systems Section

[Signature]
M. J. DELSEY
Chief Engineer,
Implementation Projects

This Preliminary Design Report summarizes
for the Burlington Skyway Freeway Traffic
1982.

es the analysis and planning effort
ic Management System as of July 1,

TABLE OF CONTENTS

	<u>PAGE</u>
1. PROJECT SUMMARY AND JUSTIFICATION.	1.
1.1 Project Location.	1.
1.2 Highway Classification.	1.
1.3 Project Purpose and Justification	1.
1.4 General Description of the Selected Alternative	3.
1.5 Project Rationale	4.
2. BACKGROUND INFORMATION	5.
2.1 History	5.
2.2 Related Projects.	6.
2.3 Transportation Studies and Long Range Perspectives. . .	7.
2.4 Chronology of Events.	8.
3. PROJECT APPROACH	10.
3.1 Project Management.	10.
3.2 External Participation.	11.
4. EXISTING AND ESTIMATED TRAFFIC CONDITIONS.	12.
4.1 Traffic	12.
4.2 Incidents	16.
4.3 Lift Bridge Demand.	18.
5. FREEWAY TRAFFIC MANAGEMENT SYSTEM.	19.
5.1 Summary of Operating Procedures	19.
5.2 Control Elements.	20.
5.3 Mode of Operation	26.
5.4 Illumination Management	34.
5.5 Right-of-Way Requirements	34.
5.6 Utilities	35.
5.6 Railways.	35.
6. BENEFITS	35.
6.1 Quantified Benefits	35.
6.2 Non-Quantified Benefits	36.
7. LEGAL AGREEMENTS AND COST SHARING.	38.
7.1 Legal Agreements.	38.
7.2 Cost Sharing.	38.

TABLE OF CONTENTS

- 2 -

	<u>PAGE</u>
8. COST ESTIMATE.	38.
8.1 Capital Costs	38.
8.2 Operating Costs	40.
8.3 Benefits Costs Assessment	40.
APPENDIX A: PROCEDURES FOR ESTIMATING BENEFITS	
APPENDIX B: 1:5000 PLATES, STAGE 1	
APPENDIX C: SUMMARY OF CORRESPONDENCE	
<u>EXHIBITS</u>	
1.1 Freeway Traffic Management System Components	2.
4.1 Monthly Volume	13.
4.2 Daily Volume	14.
4.3 Hourly Volumes	15.
4.4 Distribution of Incidents/Tie-Ups by Duration and Classification.	17.
5.1 Detector Arrangement for 3 Lane Speed Detection.	22.
5.2 Typical Message Displays	22.
5.3 Outlying Blank Out Signs	24.
5.4 Preliminary Spectrum Allocation for Coaxial Cable.	27.
5.5 Sample Strategic Response Plan	28.
5.6 Control Room	30.
5.7 Burlington Skyway System - Proposed System Layout.	32.
5.8 Software Structure	33.
6.1 Estimated Reduction in Delay Due to System Implementation. . .	37.
6.2 Quantified Benefits.	37.
8.1 Cost Estimates	39.
8.2 Benefit Cost Assessment.	41.

1. PROJECT SUMMARY AND JUSTIFICATION

1.1 PROJECT LOCATION

The study area for the Burlington Skyway Freeway Traffic Management System extends from Highway 20 - QEW Interchange in the south, northerly along the QEW - Burlington Skyway Corridor to the Guelph Line - QEW Interchange in the east and Highway 403 at Kings Road in the west. The proposed new arterial road (West Service Road) between Burlington Street and Highway 2 was also included in the study area as well as all major approaches to the QEW and the freeway system. The Queen Elizabeth Way, Highway 403 and the West Service Road are under the jurisdiction of the MTC, while the major cross-roads are under the jurisdiction of municipal and regional governments.

The Queen Elizabeth Way is divided into nine highway sections as per the Provincial Road Section Appraisal Sheets with the linear highway reference system number and offset of 10100/00.1 at the Guelph Line through to LHRS number and offset 10120/02.1 at Highway 20 in Hamilton. The total Queen Elizabeth Way distance is approximately 14.8 km all of which falls within the boundaries of District 4 of the MTC.

The major affected municipalities are the Regional Municipality of Hamilton-Wentworth, the City of Hamilton, the Regional Municipality of Halton and the City of Burlington.

1.2 HIGHWAY CLASSIFICATION

The proposed Freeway Traffic Management System would apply to both the QEW as well as the West Service Road which is to be constructed parallel to the QEW between Burlington Street and Highway 2. The QEW is a major provincial facility which is classified as a Controlled Access Highway.

1.3 PROJECT PURPOSE AND JUSTIFICATION

The QEW from Highway 20 to the Guelph Line operates under high traffic volumes with limited capacity which results in serious congestion during normal operating conditions. There are frequent accidents in the corridor which result in major delays and traffic tie-ups. In addition, the Skyway has often been closed due to inclement weather (eg. fog, high winds, etc.). As traffic continues to grow, these problems will be compounded.

In addressing the problems of this corridor, the MTC has developed a three stage construction program which will provide additional corridor capacity. The stages include:

- Stage 1 - the construction of a new arterial adjacent to the Skyway and expansion of the QEW to three lanes in each direction from north of the existing Skyway to Burlington Street;
- Stage 2 - construction of a second bridge over the canal paralleling the existing Skyway followed by rehabilitation of the existing Skyway. When this stage is completed, there will be three traffic lanes and one truck lane (on the structure only) in each direction;
- Stage 3 - in this stage, the road surface on the Skyways will be widened to allow four lanes of traffic and one truck lane (on the structure only) in each direction and major interchange work and widening will occur on the QEW south of the Skyway.

These major construction activities will relieve many of the anticipated problems. However, there is a need to minimize the problems that are anticipated until Stage 2 is completed and the additional corridor capacity is available. In addition, there is a need to minimize the effect of accidents and bad weather closings of the Skyway on traffic in the corridor. Accordingly, the objectives of the Freeway Traffic Management System are:

- to encourage local traffic to use the arterial roadway by providing information on the status of the arterial and the lift bridge;

exhibit 1.1

**FREEWAY TRAFFIC
MANAGEMENT SYSTEM COMPONENTS**

		INCIDENT MANAGEMENT	COMMUTER INFORMATION	BRIDGE MAINTENANCE
D E T E C T I O N	• Vehicle Detectors (Main Line)	0	0	S C H E D U L E D
	• Vehicle Detectors (Arterial)	0	0	
	• CB Radio	0		
	• CCTV System	0		
	• Lift Bridge Interface	0	0	
R E S P O N S E	• Changeable Message Signs	0	0	0
	• Blank Out Signs (Corridor)	0		
	• Blank Out Signs (Network)	0		
	• Intersections (Corridor)	0		
	• Lane Control Signs *	0		

* To be implemented with the completion of Stage 2

- to provide diversion capabilities and information to motorists approaching the Skyway in the event of tie-ups on the bridge or arterial due to accidents, vehicle break downs or maintenance activities.
- to provide quick response capabilities in the event of an incident so that the incident can be cleared quickly and disruption to traffic minimized.

In addition, the study will:

- determine the need for an on-going Freeway Traffic Management System following the construction of the new Skyway (i.e. the completion of Stage 2);
- provide data for an Illumination Management System.

1.4 GENERAL DESCRIPTION OF THE SELECTED ALTERNATIVE

The three major elements of the proposed Burlington Skyway Freeway Traffic Management System were developed in response to the stated objectives. The elements include:

- an incident management system which would provide quick detection, confirmation and response to incidents in the corridor with particular emphasis on the Skyway and the section of the QEW between Highway 2 and Burlington Street;
- a commuter information system which would encourage commuters between Hamilton and Burlington to use the new arterial. This commuter information system would provide travel time or other information to motorists as a means of advising them on the most appropriate travel route (i.e. arterial or QEW);
- a bridge maintenance information system. The purpose of this system would be to advise motorists in advance of bridge maintenance activities so that appropriate actions could be taken by the motorist.

Exhibit 1.1 provides a summary of the detection and response systems for each of the above identified major elements. A number of the components for the detection and response are common to a number of systems. The following provides a brief description of the detection components of the proposed system:

- Vehicle Detectors - There would be two basic functions to the vehicle detection system. The first, which would be along the Queen Elizabeth Way, would provide incident detection so that major disruptions in traffic flow could be identified quickly and appropriate responses taken. The second major aspect of the vehicle detection system would be to determine information on vehicle volumes, speed and density for use in predicting travel times along the QEW and along the new arterial. Complementing these detector stations would be presence detectors in advance of the lift bridge approach so that queue lengths could be accurately estimated and reflected in the travel time forecasts.
- CB Radio - Citizen Band Radio (e.g. Channel 9) would be monitored to provide another source of incident detection. The CB radio monitoring would be especially valuable during low volume periods when the incident detection capabilities of the road detectors would not be as sensitive to small changes in volume flow characteristics.
- CCTV - A closed circuit television system would be used as a means of identifying and confirming incidents, determining the response requirements and providing response management capabilities in the event of a major incident. The response requirements aspect of the CCTV system is considered to be especially important in that it would provide a means of identifying incident needs (e.g. fire trucks, ambulances, etc.).
- Lift Bridge Interface - This component would provide information on the lift bridge status which is important in determining commuter and incident responses.

In addition to the above detection elements, the proposed system includes the following response elements:

- Changeable Message Signs - Changeable message signs would be located at major decision points along the corridor to advise motorists of incidents, general travel conditions, diversions, commuter route information, and road and bridge maintenance activities. These changeable message signs would provide a large variety of messages which could be preprogrammed or developed on line.

- Blank Out Signs (Corridor) - These signs would be located at important decision points along the Corridor and would be actuated in the event of major diversions. Generally, they would be located at intersections and would, as necessary, revise, prohibit or institute certain key intersection movements.
- Blank Out Signs (Network) - These signs, which would have a limited number of remotely controlled messages, would be installed at major decision points well beyond the immediate corridor, replacing existing, manually operated signs (i.e. Duffs Corners, Highways 53 and 2). The purpose of these signs would be to advise motorists of Skyway closures and recommend certain alternate routes. At present, Skyway emergency procedures require work crews to travel to these existing sites to change the signs.
- Intersection Interface - The intersections within the Corridor would be affected by major diversions on the Skyway. Accordingly, each of these intersections would be linked to the main freeway traffic management control centre so that alternate timing plans could be instituted to facilitate diversions.
- Lane Control Signs - Lane control signs, which would indicate if a lane is opened or closed to traffic, are recommended for Stage 2 so that traffic lanes could be closed more safely in the event of bridge maintenance.

The above-described field detection and response elements would be coordinated and managed through a control centre. Through the control centre operator, it would be possible to interface with other control centres such as the lift bridge control room, and the OPP communications office in the Burlington Detachment. In addition, the control centre would provide for improved interface to local media as well as coordinated activities with normal MTC functions.

1.5 PROJECT RATIONALE

There are both quantifiable and nonquantifiable benefits to a Freeway Traffic Management System. Typically, quantifiable benefits relate to improved travel times and therefore reduced fuel consumption and vehicle

emissions. In assessing the benefits which could be attributed to a Free-way Traffic Management System in the Burlington Skyway Corridor, a conservative approach was taken. It was decided to use only those benefits which could easily be quantified such as improved incident detection and response so that incidents would be cleared faster. It was estimated that CCTV will account for the detection of 10% of those incidents currently detected by conventional means, such as OPP, motorist aid call boxes, and citizens band radio. In addition, CCTV will reduce the average time in confirming incidents reported by motorist aid call boxes and citizens band radio from 10 minutes to 2 minutes. Based on these two factors, it was estimated that the average incident detection and confirmation time could be reduced from 25 minutes to 21 minutes, a four minute savings.

Based on the estimate that the duration of incidents would be reduced by four minutes due to an improved detection and response system, estimates were developed of vehicle hours of travel saved. This translates to savings of 331,000 vehicle hours saved per year during Stage 1 and 143,570 vehicle hours per year in Stage 2. Based on estimated values of person time, fuel costs and commercial vehicle costs, the annualized dollar savings are \$2,765,000 in Stage 1 and \$1,209,000 in Stage 2. These annual benefits result in benefit/cost ratios of approximately 2.6 to 1 in each of the two stages.

It is important to stress that the quantified benefits are based on reduced incident duration times only and do not include the benefits of the motorists information components which would allow drivers to adjust routings and general travel patterns.

In addition, there would be a large number of other benefits including:

- reduced potential for accidents after an incident has occurred;

- effective implementation of diversions either because of vehicle incidents or bad weather with more efficient use of manpower;
- reduced traffic demand on the Skyway with an associated reduction in unstable flow conditions;
- improved safety for maintenance crews along the corridor.

Based on the analysis of traffic conditions on the Burlington Corridor of the QEW, as well as the proposed reconstruction program, it is concluded that:

- a Freeway Traffic Management System would be effective both on completion of the Stage 1 construction program as well as subsequent to the completion of Stage 2;
- a Freeway Traffic Management System would help to reduce congestion and traffic problems on the Skyway;
- the accident reduction and other non-quantifiable benefits of a Freeway Traffic Management System could be significant.

2. BACKGROUND INFORMATION

2.1 HISTORY

The Queen Elizabeth Way is a major provincial highway between Toronto and Niagara Falls. The highway provides a vital link to the Golden Horseshoe area at the west end of Lake Ontario.

The highway was initially opened in 1939 as an expressway. As traffic continued to grow, grade-separated interchanges were constructed so that the Queen Elizabeth Way presently operates as a controlled access freeway. There are, at present, six lanes on the freeway from Toronto to Highway 403 in Burlington and four lanes from Burlington to Hamilton and beyond to Fort Erie.

This report deals with that section of the Queen Elizabeth Way from approximately the Guelph Line in Burlington through to Highway 20 in Hamilton. Included in this section is the Burlington Channel entrance to Hamilton Harbour. The Queen Elizabeth Way crosses the Channel on a four lane bridge, the Burlington Skyway, that was constructed in the late '50s and opened to traffic in 1958. In addition, there is a lift bridge which crosses the Channel, providing a two lane connection via Beach Blvd. between Hamilton and Burlington. This lift bridge incorporates, at present, a two lane roadway and a single track CNR railway spur. The bridge which is under the jurisdiction of Public Works Canada, was opened in 1962. As part of the Stage 1 redevelopment of the Queen Elizabeth Way, a four lane arterial will be constructed across the Beach strip and the lift bridge deck will be modified to accommodate a four lane road right-of-way. Included with this work is the removal of the rail spur south of the Channel and from the bridge itself so that rail traffic will not interfere with road traffic.

Since the initial opening of the Burlington Skyway, traffic volumes have continued to increase. For example, the traffic on the Skyway was approximately 17,000 AADT (annual average daily traffic) in 1960. By

1970, the AADT had increased to 34,600 and to 56,900 AADT by 1980. This growth is expected to continue so that by the year 2000, the demand on the corridor is estimated to be approximately 100,000 AADT.

As a result of the problems caused by this high traffic demand on the facility and especially by the congestion which results from even minor incidents, the Ministry of Transportation and Communications submitted an environmental assessment report covering three stages of proposed reconstruction of the Queen Elizabeth Way to the Ministry of the Environment in 1979. These proposed reconstruction stages are:

- Stage 1 - a new four lane arterial across the Beach strip between Burlington St. and Highway 2 and reconstruction of the Queen Elizabeth Way between Highway 2 and Highway 403 to six through-lanes;
- Stage 2 - "twinning" of the Burlington Skyway over the Burlington Channel and constructing six through-lanes on the Queen Elizabeth Way through to Burlington Street from Highway 2;
- Stage 3 - upgrading to three through-lanes in each direction throughout the corridor and interchange modifications in Burlington and Hamilton. This would represent the ultimate design of this section of the Queen Elizabeth Way.

The government review of the 1979 submission was issued on April 28, 1981. This review recommended approval of the construction of the Stage 1 improvements subject to a number of conditions. The review further recommended that the decision on Stages 2 and 3 should only be taken after the Ministry of Transportation and Communications has submitted a further environmental assessment report. Subsequently, a request was made and permission granted to remove Stages 2 and 3 from the submission. With this done, the Minister of Environment issued a notice of acceptance of the environmental assessment for Stage 1 dated July 23, 1981. The Stage 1 redevelopment of the Queen Elizabeth Way was approved for construction by Order in Council 2921/81 dated the 15th of October, 1981. Since the approval, detail design work on Stage 1 has proceeded and the first contracts for Stage 1 were awarded during the summer of 1982.

In accordance with the ruling on the initial environmental assessment report, the Ministry of Transportation and Communications has prepared an environmental assessment report for the Queen Elizabeth Way between Burlington and Hamilton for Stage 2 and Stage 3 redevelopment. This document is dated May 1982. This document was also approved by the Ministry of the Environment.

2.2 RELATED PROJECTS

The three stages of the redevelopment program for the Queen Elizabeth Way have a major impact on a Freeway Traffic Management System (FTMS) in that the road system will ultimately dictate how the Freeway Traffic Management System should operate. However, the greatest benefits of a Freeway Traffic Management System are expected during the interim period until the major redevelopment has been completed. In this regard, the Stage 1 redevelopment is critical because ramps are to be provided north and south of the Skyway so that traffic can be rerouted to the new arterial which is to be constructed parallel to the QEW. This arterial will also provide an alternate route for commuters. It is therefore the objective of the Freeway Traffic Management System that the system be in place upon the completion of Stage 1 redevelopment. However, the Stage 1 redevelopment is to be undertaken as seven separate projects as follows:

- construction of the new arterial south of the Burlington Channel up to and including the on/off ramps with the QEW;
- construction of the Burlington Street interchange with Woodward Avenue and the new arterial;
- construction of the arterial adjacent the QEW between Burlington Street and the QEW on/off ramps;
- redevelopment of the lift bridge which crosses the Burlington Channel;
- reconstruction of the arterial north of the Burlington Channel including the on/off ramps to the QEW and the QEW itself through to Lockhart Road;

- redevelopment of the QEW between Lockhart Road and the CNR;
- redevelopment of the QEW between the CNR crossing and Highway 403.

Because many of the system components of the Freeway Traffic Management System can be installed as part of these roadwork contracts, the overall completion of the Freeway Traffic Management System is, therefore, tied into these construction activities. Other major projects which will have some bearing on the Freeway Traffic Management System include the following:

- Burlington Street - The Regional Municipality of Hamilton-Wentworth is proceeding with the reconstruction of Burlington Street from Kenilworth Avenue to Parkdale Road where it will connect to the reconstruction of the Burlington Street/Woodward Avenue interchange proposed as part of the Stage 1 redevelopment of the Queen Elizabeth Way. Burlington Street when reconstructed will provide a four lane elevated facility over four lanes at grade.
- Highway 403 - A preliminary design study is presently underway for Highway 403 between the Freeman Interchange and the Oakville/Mississauga boundary. This new highway will follow a route that was designated in 1962 and now forms part of the Parkway Belt West. It is expected that Highway 403 will be constructed as six lanes and the first stage of construction will be the section from the Mississauga boundary westerly.

2.3 TRANSPORTATION STUDIES AND LONG RANGE PERSPECTIVES

2.3.1 Traffic Volumes

As part of the environmental assessment report for Stage 2 and Stage 3 of the redevelopment of the QEW in the corridor, traffic volumes were forecast for the year 2001. Assumptions inherent in these forecasts were:

- land use will occur as indicated in the Hamilton-Wentworth and Halton Official Plans with a Regional population of 445,000 in 2001;
- per capita vehicle registration and usage will occur as predicted (i.e. as an extension of present trends assuming continued fuel availability);
- international traffic will form a similar percentage of the total traffic in the future as it has in the past;
- Highway 5 will have been reconstructed to a four lane cross-section from Oakville to Highway 6. Fairview Street and New Street will have been constructed across the Bronte Creek;
- interchanges will exist on the QEW as proposed in the complete redevelopment (Stages 1, 2 and 3).

Based on these assumptions, the Ministry of Transportation and Communications generated future traffic volumes and assigned them to alternative networks. The resulting volume assignments indicated a demand on the QEW corridor between Highway 2 and Burlington Street of between 82,000 AADT and 100,000 AADT (applied to both the Queen Elizabeth Way and the improved arterial adjacent to the QEW).

It was further expected that the traffic on the corridor would reflect certain characteristics as follows:

- truck percentages would remain at 12% during the peak hour and 16% on a daily basis;
- a 60-40 directional split during peak periods;
- the design hour volume is expected to be approximately 12% of the AADT;
- the weekday composition of traffic on the corridor will consist of:
 - 27% through traffic,
 - 35% local traffic,
 - 38% external traffic;
- the modal split within the corridor will not be appreciably altered.

The environmental assessment study further analyzed the impact of these traffic volumes on the capacity conditions for the QEW. From this analysis, it was concluded that major additional capacity would be required in the corridor.

Also as part of the environmental assessment study, a number of other issues were addressed including accident rates and maintenance of the existing Skyway.

2.3.2 Accident Rates

Accident rates have an important impact on the need for a Freeway Traffic Management System. Accident rates are a preferred indicator because they can be applied to future traffic volumes to estimate total accidents. The Ministry of Transportation and Communications undertook an analysis of accidents in the corridor and summarized the results in the environmental assessment report for the primary proposed construction program. The finding was that accident rates were related to a volume capacity relationship as follows:

$$\begin{array}{l} \text{accident rate} \\ \text{(accidents per} \\ \text{million vehicle} \\ \text{kilometres)} \end{array} = \frac{1.25 \times \text{annual average daily traffic}}{\text{theoretical breakdown capacity of Skyway}}$$

This equation generally reflects the accident rate per million vehicle kilometres of travel between 1964 and 1978. Generally, the rate has been increasing proportionally to the increase in traffic volumes so that the accident rate is now approximately 1.8 accidents per million vehicle kilometres. By way of comparison, this is appreciably higher than the provincial average for freeways of 0.7 accidents per million vehicle kilometres. Of particular note is the fact that the accident rate is most critical in the immediate area of the Skyway with rates ranging from 2.0 to 2.3 accidents per million vehicle kilometres.

As evident from the above equation, it would be reasonable to expect that the accident rate will increase proportionally to the increase in traffic volumes on the corridor until such time as there is a major increase in capacity. This will result in a geometric increase in total accidents.

2.3.3 Vehicle Breakdowns

Another important factor in terms of a Freeway Traffic Management System is the number of vehicle breakdowns. From data maintained on incidents on the Skyway, there are approximately 700 vehicle breakdowns per year. Generally, these are on average 15 minutes in length but do on occasion extend to durations in excess of 60 minutes. Because there are no shoulders on the Skyway, these vehicle breakdowns result in a lane blockage with significant impacts on through traffic flow characteristics. Vehicle breakdowns would generally be directly proportional to traffic volumes so that vehicle breakdowns are forecasted to increase over the period through to the completion of Stage 3 redevelopment.

2.3.4 Bridge Maintenance

Maintenance incidents vary widely in terms of duration ranging from critical maintenance (e.g. debris on the bridge) to scheduled maintenance to replace lighting or for general bridge repairs.

2.4 CHRONOLOGY OF EVENTS

The problems of the Burlington Skyway-QEW Corridor have been considered for some time as witnessed by the initial environmental submission in December of 1979 and the subsequent approval to proceed with the Stage 1 construction in October 1981.

The initial concept of a Freeway Traffic Management System for the Burlington Skyway was first considered by the MTC in January 1981. In June of 1981, the MTC established a Freeway Traffic Management Systems Section as part of the Traffic Engineering Office. In July of 1981, IBI Group was retained to develop a preliminary design for the Freeway Traffic Management System for the Corridor. In January 1982 a concept design for a Freeway Traffic Management System was prepared and presented to the project Steering Committee and Mr. T.G. Smith, Director, MTC Central Region. In May 1982, the preliminary design was presented to the Steering Committee for final approval and subsequently presentations were made to Mr. T.G. Smith, and the Management Review Committee of the MTC. Other approvals were acquired from the Steering Committee which included representatives from the local municipalities and regional governments. In addition presentations were made to the City of Hamilton, the Regional Municipality of Hamilton-Wentworth and the Regional Municipality of Halton. The following summarizes in chronological order the major events of the project:

<u>Date</u>	<u>Event</u>	<u>Purpose/Outcome</u>
December 9, 1981	Presentation of Concept Plan to Project Team	Concept Plan Endorsed
January 6, 1982	Presentation of Concept Plan to Steering Committee	Concept Plan Endorsed
January 20, 1982	Presentation of Concept Plan to the Regional Director, Central Region	Concept Plan Endorsed
May 7, 1982	Preliminary Design presented to Project Team	Preliminary Design Accepted
May 20, 1982	Preliminary Design presented to Steering Committee	Preliminary Design Accepted

<u>Date</u>	<u>Event</u>	<u>Purpose/Outcome</u>
May 31, 1982	Preliminary Design Presented to the Regional Director, Central Region, MTC	Preliminary Design Accepted
June 9, 1982	Preliminary Design Presentation to Management Review Committee, MTC	Approval Deferred
August 5, 1982	Presentation to Strategic Policy Committee, MTC	Proposed Freeway Traffic Management System Approved
October 25, 1982	Presentation to the Councils of the City of Hamilton and the Region of Hamilton-Wentworth	Proposed Freeway Traffic Management System Endorsed
November 15, 1982	Presentation to Councils of the Region of Halton and the City of Burlington	Proposed Freeway Traffic Management System Endorsed
December 2, 1982	Public Information Session, Woodward Avenue Public School, Hamilton	Public Input
December 3, 1983	Public Information Session, Burlington Central Library, Burlington	Public Input

3. PROJECT APPROACH

3.1 PROJECT MANAGEMENT

The Freeway Traffic Management Systems Section of the Traffic Management and Engineering Office of the MTC was responsible for the day-to-day management and administration of the Burlington Skyway Freeway Traffic Management System project. A Project Team was formed consisting of representatives from various MTC offices and the project consultant and a Steering Committee was established consisting of representatives from municipalities, MTC offices and the consultant. IBI Group was retained as the project consultant to assist the Ministry of Transportation and Communications with the project.

3.1.1 Project Team

The Project Team was formed as a means of providing input from the various MTC offices. The Team met on a monthly basis and had participation from the following offices:

- Mr. Ed Ellard, Project Manager, Freeway Traffic Management Systems Section, Traffic Engineering Office
- Mr. Colin Rayman, Head, Freeway Traffic Management Section, Traffic Engineering Office
- Mr. Dick Shannon, Head, Traffic Section, Central Region
- Mr. S. Stewart, Project Manager, IBI Group
- Mr. Derek Sims, Project Engineer, IBI Group
- Mr. Rod Edwards, Traffic Analyst, Traffic Section, Central Region
- Mr. Paul Askie, Project Manager, Planning & Design Section, Central Region
- Mr. W. Berkis, Electrical Design Section, Central Region
- Mr. Martin O'Sullivan, Electrical Design Section, Central Region

- Mr. J. Loughheed, Maintenance Services Supervisor, District 4 - Hamilton
- Mr. J. Nation, District 4 - Hamilton
- Mr. Nat Sen, Senior Project Manager, Planning & Design Section, Central Region
- Mr. C. Willis, Transportation Planner, Highway Program Development Branch
- Mr. J. Tsai, Systems Research Branch
- Mr. M.G. Abrahamson, Systems Research Branch
- Mr. G.A. Oster, Special Services Office
- Mr. J. Shragge, Public and Safety and Information Branch
- Mr. M. English, Transit Office
- Mr. G. Norman, Maintenance Engineer, District 4 - Hamilton

Sub-consultants including JHK & Associates, Teleride, and GABL-19 attended the Project Team meetings as required.

3.1.2 Project Steering Committee

The overall project was directed through a Steering Committee which met a total of three times during the project to review the original scope of the project, the concept plan and the preliminary design. The Committee consisted of MTC and Municipal representatives including:

- Mr. M.D. Harmelink, Manager, Traffic Engineering Office
- Mr. R.A. Shannon (Chairman), Head, Traffic Section, Central Region
- Mr. E.R. Case, Manager, Control Systems, Research & Development
- Mr. V.R. Berkis, Electrical Design Supervisor, Highway Design Office, Central Region
- Mr. Joe Pavelka, Regional Municipality of Hamilton-Wentworth

- Mr. D. R. McCleary, Regional Planner, Regional Municipality of Halton
- Mr. Ray Desjardins, Commissioner of Traffic, City of Hamilton
- Mr. M. Powell, Manager of Traffic and Transportation Planning, City of Burlington
- Superintendent D.L. Dowser, Inspector, Ontario Provincial Police
- Mr. B. Sanderson, Superintendent, Hamilton-Wentworth Regional Police
- Mr. D. Richards, Planning Officer, Halton Regional Police
- Mr. R.P. Fillmore, Marine and Civil Engineer, Public Works Canada
- Mr. G. Norman, MTC District 4, Maintenance Engineer
- Mr. J. Gleason, previously Manager, Traffic Engineering Office

3.2 EXTERNAL PARTICIPATION

3.2.1 Municipal Involvement

Once the preliminary design for the Burlington Skyway Freeway Traffic Management System was completed and had received endorsement from MTC Senior Management, presentations were made and approvals sought from affected municipalities. The first presentation was made October 25, 1982 to the Joint Transportation Committee of the City of Hamilton and the Regional Municipality of Hamilton-Wentworth. At the meeting, the objectives of the Burlington Skyway Freeway Traffic Management System were presented and the proposed system was discussed.

The Committee provided approval in principle and a copy of the resolution is contained in Appendix C.

On November 15, 1982, a presentation was made to a joint committee of the Region of Halton and the City of Burlington. The presentation included an overview of the system objectives, the system components and expected benefits. The project received the support of the committee and a copy of the resolution is attached in Appendix C.

A subsequent presentation took place on December 6, 1982, to the City of Hamilton Transportation and Environmental Committee. Again, the system objectives, components and expected benefits were described.

Two public information sessions were held, the first was held in Hamilton at the Woodward Avenue Public school on December 2, 1982 and one at the Burlington Central Library in Burlington on December 3, 1982. At the drop in centres, displays were available to describe the proposed system to the public. Some 20 people attended the drop in session at the Woodward Avenue Public school and 40 people attended the drop in centre at the Burlington Central Library. The proposed system was generally supported by those who attended and no objections were raised.

3.2.2 External Meetings

Through the course of the project, a number of meetings were held with special interest groups, other consultants involved in the roadwork contracts, and equipment suppliers. Of special interest were meetings held with:

- Corporal Jim Harrington, OPP
- Staff-Sergeant Bill Potter, OPP
- Superintendent H. Knox, OPP
- Tom Coldridge, OPP
- Inspector Mac Wilson, OPP
- Superintendent D.L. Dowser, OPP
- Mr. R.P. Fillmore, Public Works Canada
- Mr. Warren Beck, News Director, CHML, Hamilton
- Ms. M. Hollis, Hamilton Co-axial
- Mr. T. Dobbie, City of Burlington

4. EXISTING AND ESTIMATED TRAFFIC CONDITIONS

4.1 TRAFFIC

The Burlington Skyway-QEW Corridor accommodates between 55,000 and 60,000 AADT. This has grown from 17,000 AADT in 1960 with a resulting average annual growth rate of approximately 6% per year.

Beach Blvd. which parallels the Skyway presently accommodates in excess of 10,000 AADT.

The Queen Elizabeth Way experiences significant increases in traffic volumes during the summer period. Although the AADT for 1980 was approximately 56,900, the SADT (summer average daily traffic) was in the range of 69,000. Exhibit 4.1 provides a summary of daily traffic volumes on the Burlington Skyway by month. The exhibit provides an indication of the AADT, the SADT and the theoretical breakdown capacity of the Skyway. It is noteworthy that the theoretical breakdown capacity of the Skyway is 40,000 vehicles per day. This breakdown estimate is as calculated in the environmental assessment report for Stages 2 and 3 of the Queen Elizabeth Way redevelopment program. Of special interest in examining Exhibit 4.1 is that the number of commuters does not vary appreciably over the 12 month period and that the increase in traffic during the summer period is associated with recreational and vacation travellers who are not necessarily familiar with the area.

Exhibit 4.2 provides a summary of the daily volume on the Skyway as a function of the day of the week. The daily volumes during weekdays are generally quite similar except for Fridays when there is significant increase both in the winter and the summer. The volumes on the Skyway are reduced somewhat on Saturdays and Sundays. However, mid-day peaking conditions on Saturdays and Sundays are much more extreme than on the weekdays.

Another important factor in examining the traffic conditions on the Skyway and the QEW Corridor is the peaking characteristics. From

Exhibit 4.3, it is evident that the peak demand occurs between 7:00 a.m. and 9:30 a.m. and 3:00 p.m. and 5:30 p.m. During the peak period, the Skyway accommodates approximately 2,600-2,700 vehicles per hour per direction. This is very close to the capacity of the facility based on the Highway Capacity Manual method (Special Report 87) which results in a peak hour capacity per direction of approximately 2,750 vehicles reflecting both the grade of the facility as well as the high proportion of trucks.

The Burlington Skyway-QEW Corridor is a vital highway link for traffic between the United States, Niagara Falls and Hamilton, to areas north and east including Metro Toronto. As a consequence, there is a large number of commercial vehicles especially trucks, using the Skyway. Because of the operational difficulties imposed on loaded trucks by the Skyway, the MTC has designated the right lane for trucks and other slow-moving vehicles. In this way, one through lane is maintained for passenger cars. In spite of this there is still traffic congestion on the Skyway due to heavy traffic volumes.

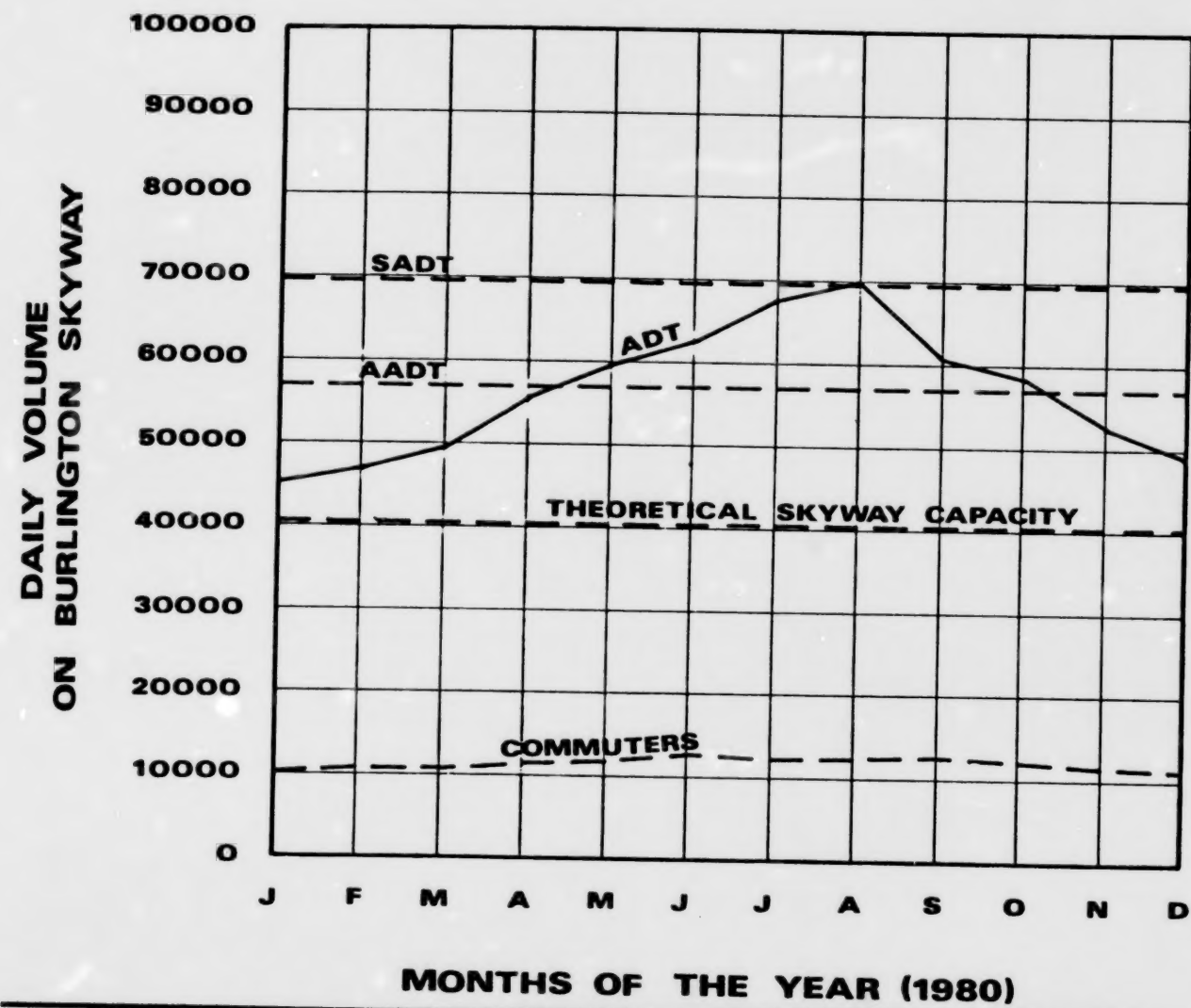
Commuters account for approximately 60% of the total traffic volume during the peak periods. Generally, the commuters travel between the Bayfront industrial area of Hamilton and the residential area of Burlington. During the peak periods there is a 60-40 directional split. At most other times of the day, traffic has a balanced flow.

4.1.1 Future Traffic

The Ministry of Transportation and Communications has prepared travel forecasts for the Burlington Skyway Corridor for the year 2001. The assumptions for these predictions are:

- land use will occur as indicated in the Hamilton-Wentworth and Halton Official Plans;
- per capita vehicle registration and usage will occur on the basis of existing trends;
- through traffic on the corridor will grow in accordance with the traffic growth within the corridor.

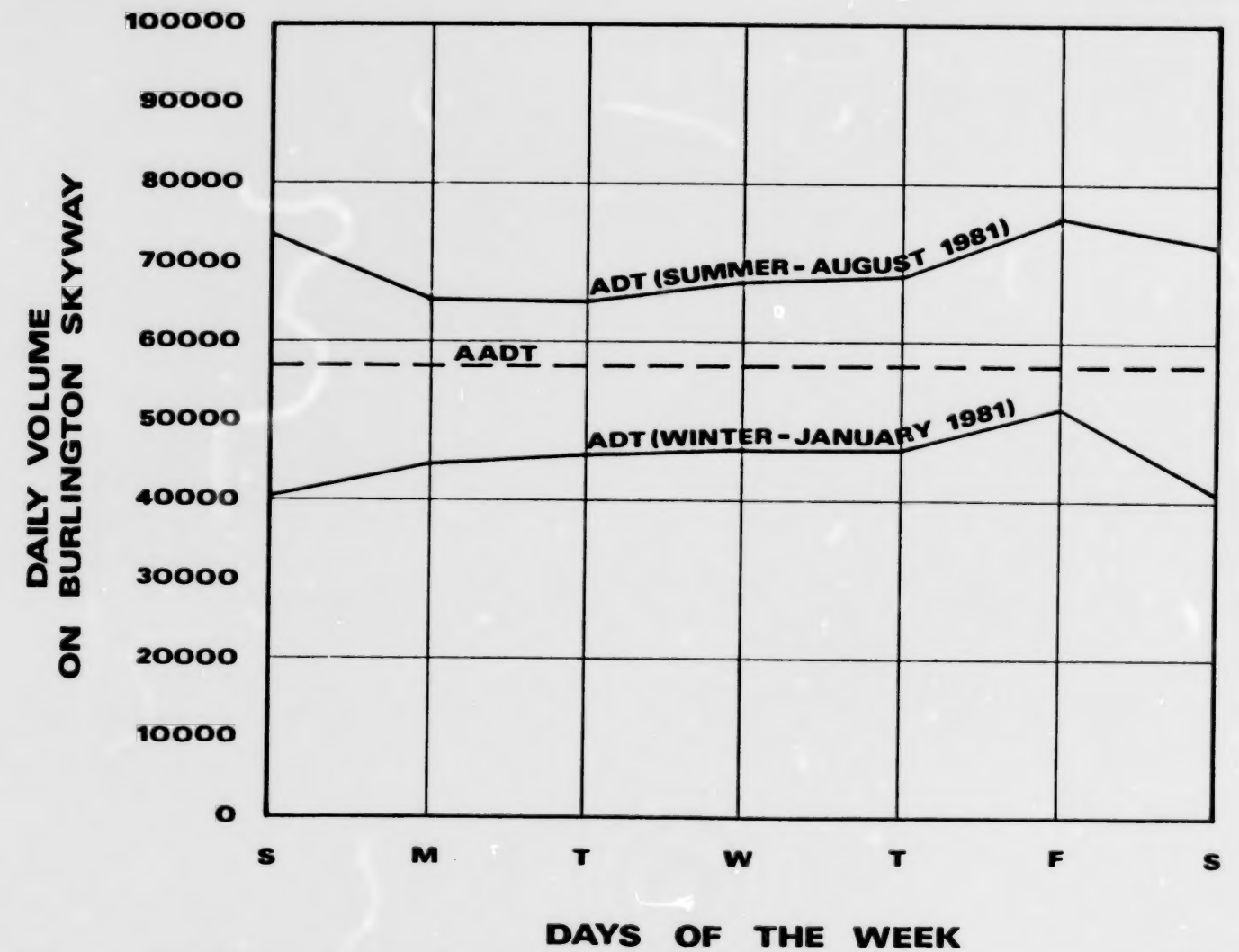
exhibit 4.1
MONTHLY VOLUME



IBI Group

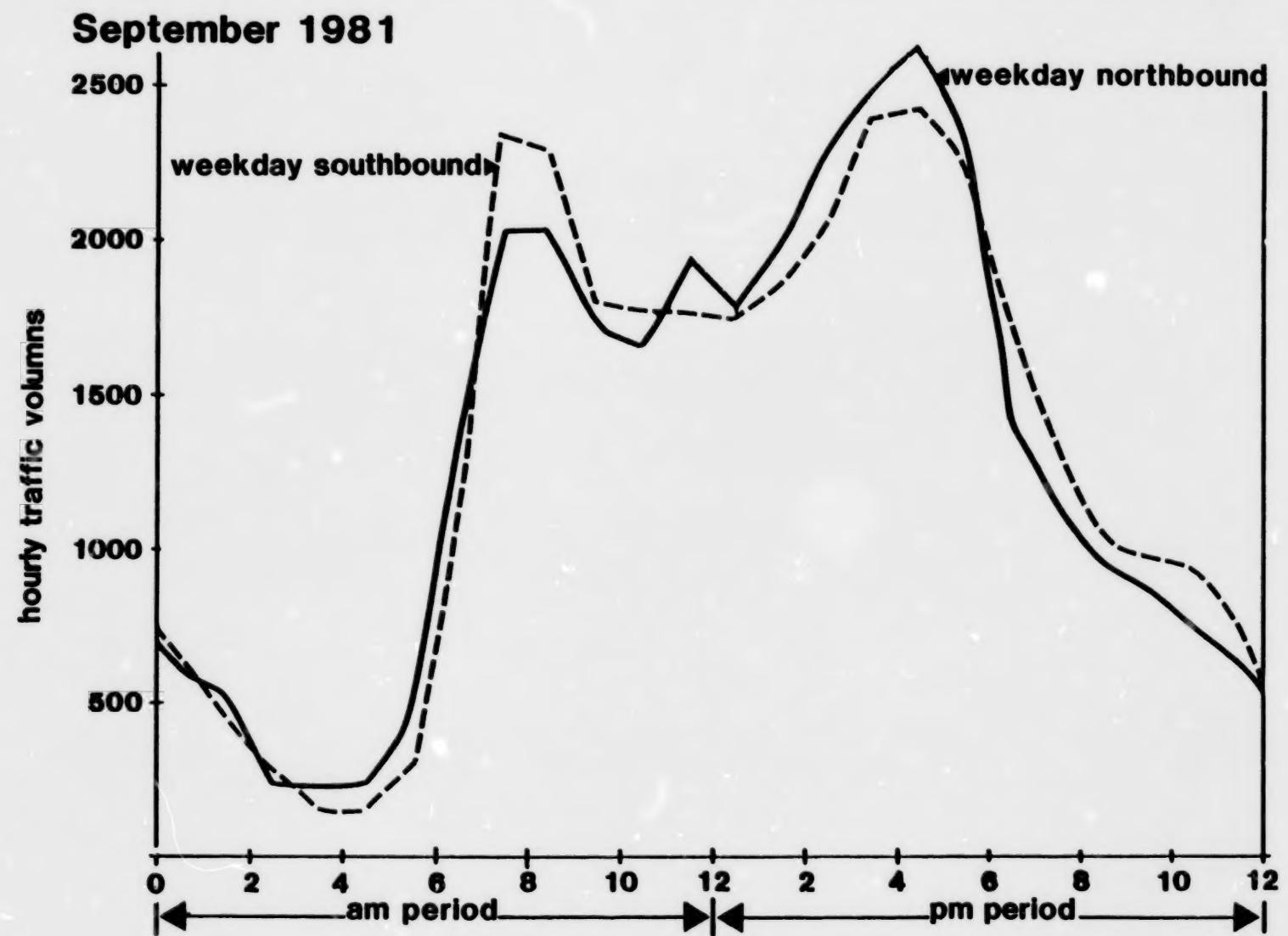
exhibit 4.2

DAILY VOLUME



IBI Group

exhibit 4.3
HOURLY VOLUMES



Based on these assumptions, forecasts were prepared by the MTC and as summarized in the environmental report on travel demand in the corridor. For the recommended redevelopment program in the environmental assessment report for Stage 2 and Stage 3, the expected volumes on the QEW between Guelph Line and Highway 20 exceed 110,000 AADT in some areas. The assumptions related to the 2001 forecast include:

- peak hour demand will be approximately 12% of AADT;
- there will be a 60-40 directional split;
- the modal split on the corridor will be approximately 5%.

The forecast growth in the demand on the corridor has resulted in the MTC's proposed three stage redevelopment program and highlighted the potential for a Freeway Traffic Management System to minimize the impact of congestion on the corridor.

4.2 INCIDENTS

4.2.1 Existing Incidents

Exhibit 4.4 provides a summary of existing incidents on the Burlington Skyway for 1981 based on data gathered by the District MTC office in Burlington. In the period there were approximately 1,000 incidents broken down as follows:

- 143 accident incidents;
- 719 vehicle breakdowns;
- 119 maintenance activities.

The average duration of these incidents on the Skyway was approximately 30 minutes.

Based on data available from the 401 Corridor Traffic Systems Management Study conducted by the MTC, an estimate was developed of the

number of incidents in terms of full (two lanes) or partial (one lane) closures for the Burlington Skyway. These are summarized as follows:

Estimated Distribution of Closures by Type

	<u>Full Closure</u> (two lanes)	<u>Partial Closure</u> (one lane)
Accidents	6.8%	93.2%
Vehicle Breakdowns	1.0%	99.0%
Maintenance	-	100.0%

It is important to stress that all incidents on the Skyway result in at least one lane being closed because of the lack of shoulder space.

Based on Exhibit 4.4 the average duration of incidents was calculated according to incident type as illustrated by the following:

-	Accidents	-	33.8 minutes
-	Vehicle Breakdowns	-	26.3 minutes
-	Maintenance	-	27.1 minutes

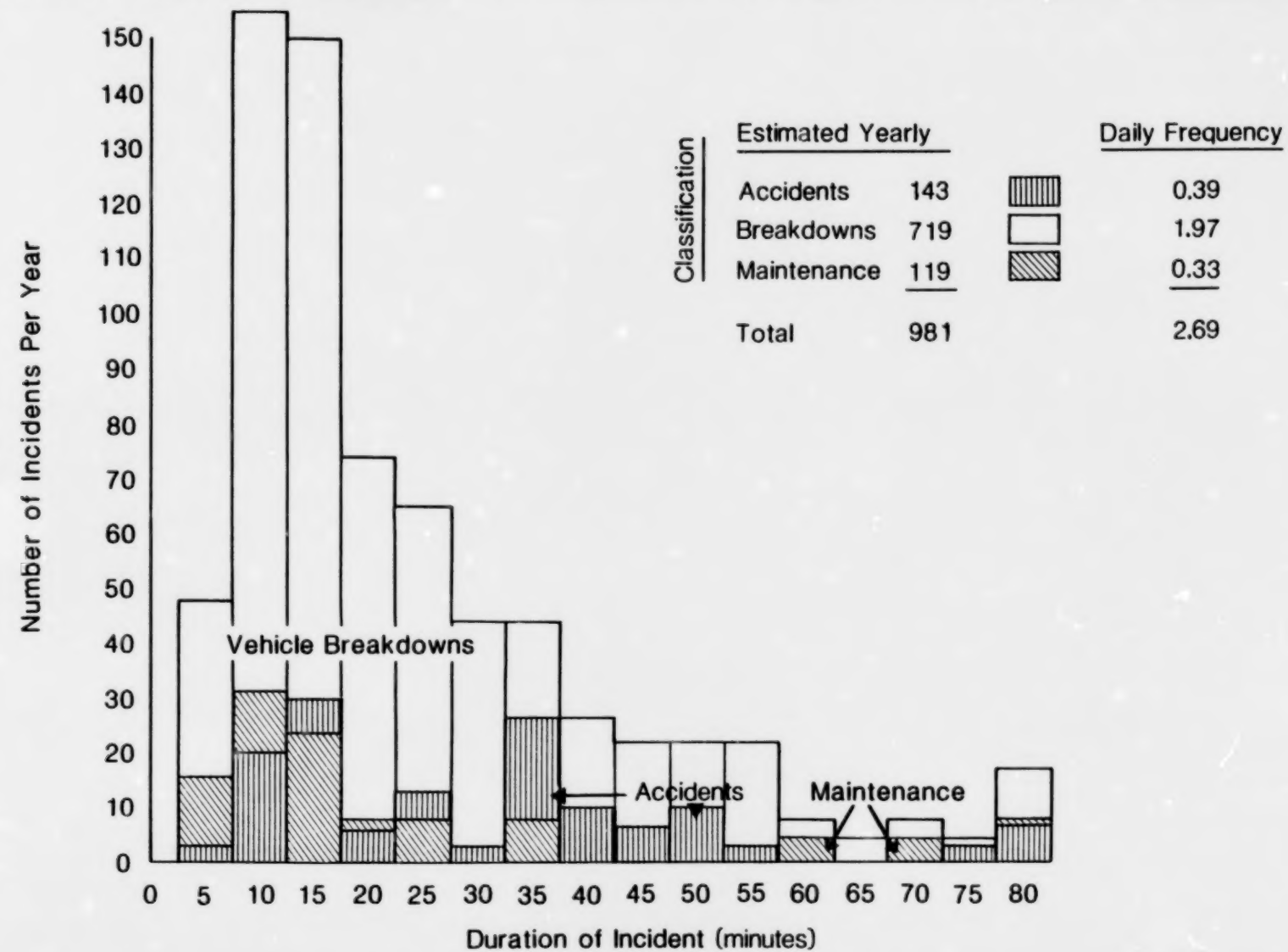
Because these estimates of duration do not include a report time (i.e. time when an incident occurred to time authorities are notified) the total duration is longer. It was estimated that the report time for Skyway incidents is 2 minutes.

4.2.2 Future Incidents

The future tie-ups and incidents will generally be a function of the volume/capacity ratio and the traffic volume.

The Ministry of Transportation and Communications has developed a relationship between the v/c ratios and accident rates for the corridor

exhibit 4.4

DISTRIBUTION OF INCIDENTS/TIE-UPS BY DURATION & CLASSIFICATION

Note: Total incidents/tie-ups by duration can be derived by adding the number of incidents by classification.

IBI Group

1

indicating that the accident rate increases in direct proportion to the v/c ratio. The provincial equation is as follows:

$$\text{Accident Rate} = \frac{1.25 \times \text{annual average daily traffic}}{\text{theoretical breakdown capacity of Skyway}}$$

Based on this equation, the accident rate will continue to increase on the Skyway until such time as the Skyway is widened and the capacity increased. Following that, the accident rate would decrease appreciably. It should be pointed out that until such time as capacity is added, the number of accidents will increase geometrically in accordance with the increases in accident rate and traffic volume.

The frequency of vehicle breakdowns, the largest incident type on the Skyway, is generally proportional to the traffic volume. Thus, and until such time as Stage 2 is completed when there will be shoulder space to accommodate such vehicles, vehicle breakdowns will have an ever-increasing impact on traffic flow on the Skyway.

The maintenance incidents are generally due to lane closings often resulting from materials (e.g. debris) falling on the Skyway and posing some impediment to smooth-flowing traffic. These were considered independent of traffic volume characteristics. Moreover, there will still be a need to continue this maintenance function.

4.3 LIFT BRIDGE DEMAND

The Burlington Channel presently accommodates approximately 11,000 vessels per year. The largest proportion, some 8,000-9,000 vessels, are comprised of launches or other pleasure craft such as sailboats which require short lifts, usually less than 5 minutes in duration. Bulk carriers, pilot boats and other commercial vessels account for the remaining demand with the average duration of a lift being more than 10 minutes for larger vessels.

In 1981, there were a total of 4,400 lifts of the lift bridge on the Burlington Channel with 2,100 for pleasure craft and 2,300 for other commercial vessels. On average, each pleasure craft lift accommodated four vessels.

Because of the high demand for pleasure craft lifts, a practice has been instituted whereby the bridge is lifted at regular half-hour intervals in the event of pleasure craft demand. This consolidates demand and minimizes the impact of the lifts on traffic flow along Beach Blvd.

Bulk carriers and other commercial vessels including pilot boats, tugs, etc. are not subject to the half-hour regulation; when a lift is requested for these vessels, the lift bridge operator must respond.

Bulk carriers and commercial vessels have a random demand and require lifts of a longer duration than pleasure craft. For example, some lifts for larger vessels can be as long as 15 or 20 minutes whereas the pleasure craft lifts may take no more than 3 to 5 minutes.

The greatest demand for the lift activities is during the summer months with May through September accounting for approximately 75% of the total lifts in a year. This is due to the large pleasure boat activity centred in Hamilton Harbour.

Usually, the lift bridge is not raised in January, February and part of March because of the closing of the shipping season.

Train traffic on the lift bridge has been relatively light. In 1980 there were 180 train movements. In light of recent negotiations with the CNR, the train track is to be removed from the lift bridge so that a full four lane right-of-way can be provided for traffic with uninterrupted flow.

5. FREEWAY TRAFFIC MANAGEMENT SYSTEM

The review of incidents in the previous chapter indicated a need for an incident management system which would provide an improved means of identifying, responding to and clearing incidents. Another feature of the corridor is the high percentage of commuters between the Bayfront area in Hamilton and the residential area in Burlington. Because of the new arterial to be constructed as part of the Stage 1 redevelopment, there is a significant opportunity to encourage commuters to use this facility thereby relieving demand on the Skyway, especially during that period up to the completion of Stage 2 when additional capacity would be available in the corridor. Also there is an opportunity to improve the means by which maintenance can be carried out on the Skyway safely and efficiently. Three major sub-systems to the Freeway Traffic Management System were identified as follows:

- an incident management system to improve the detection, response and clearance times of incidents;
- a commuter information system to advise commuters of the relative advantages of using the new arterial adjacent the QEW;
- a bridge maintenance management system to advise motorists of maintenance activities thereby minimizing the disruption of these activities to motorists and also improving the safety for maintenance crews.

Provisions have been made in the Freeway Traffic Management System to provide input to an Illumination Management System. This input consists of traffic volume and speeds at key locations in the corridor. Based on these data, the Illumination Management System will adjust lighting levels in the corridor.

5.1 SUMMARY OF OPERATING PROCEDURES

5.1.1 Incident Management

The purpose of the incident management system is to identify, confirm and clear incidents so that normal traffic flow is restored quickly. There are two major elements to an incident management system, incident detection and incident response. Incidents can be detected in a variety of ways including detectors, CB radio, cameras, etc. Incident responses include initiating the appropriate steps to clear the incident and providing motorists with appropriate advisory information on traffic conditions and alternate routes.

The incident management system makes use of the following detection elements:

- the vehicle detectors on the main line will be used to detect unexpected changes in traffic flow characteristics and act as an initial means of identifying incidents. These detectors will provide occupancy, speed and volume information and will be located at regular intervals along the QEW (e.g. 500 to 800 m);
- the detector data will be monitored by the central computer to determine volumes and general traffic flow conditions;
- detectors on the arterial will be used to monitor traffic flow on the arterial;
- the CB radio monitoring will provide information on incidents, their location, and type;
- the CCTV system will allow the operator at the control centre to confirm incidents, and determine the most appropriate response. The cameras will be spaced at distances of approximately 1500 metres. The operator will have full control of the cameras including pan, tilt, zoom capabilities;
- the lift bridge interface system will allow the operator to consider anticipated lifts of the bridge. With this, he will be better able to provide advice on commuter routes.

The response elements of the incident management system will include:

- changeable message signs at strategic decision points throughout the corridor so that diversions (both mandatory and voluntary) can be instituted. Also, these signs can be used to advise motorists of traffic conditions such as congestion;
- blank out signs within the corridor to notify motorists of restricted movements at major intersections when diversions are in effect;
- blank out signs at outlying intersections that will advise motorists of alternate routes when the Skyway is closed;
- interface capabilities to the local intersections in the corridor so that timings and phasings can be adjusted according to demand;
- lane control signs so that on the Skyway lanes can be closed to traffic to minimize the potential for accidents, etc.

5.1.2 Commuter Information System

The commuter information system will be used to advise commuters between Hamilton and Burlington of the lift bridge status and general travel conditions. The purpose is to encourage commuters to use the new arterial.

The commuter information system will rely on vehicle detectors to assess speed and travel time between Burlington Street and Highway 2, for both the QEW and the arterial. Queue detector stations are located on the arterial in advance of the lift bridge. These detectors will provide information on queue lengths associated with lifts of the bridge. This information can then be used to estimate queue clearance times and travel times on the arterial.

The lift bridge interface system will provide information on anticipated lifts, their expected duration as well as when they actually occur. This can be used by the operator along with the travel time data on the arterial and the QEW to advise motorists of the most appropriate route.

The response systems for the commuter information system will consist of:

- the changeable message signs at strategic locations (Burlington Street, and in advance of Highway 2 off ramp) providing information on the two commuter routes or simply lift bridge status information (e.g. "bridge up");

5.1.3 Bridge Maintenance Motorist Information System

The bridge maintenance motorist information system is largely directed at major scheduled bridge maintenance activities so that maintenance can be conducted with improved safety and the impact on motorists minimized. The response system for this will include:

- changeable message signs to advise motorists to be cautious or to take alternate routes;
- lane control signs to redirect traffic and indicate if a lane is closed.

5.2 CONTROL ELEMENTS

5.2.1 Vehicle Detection System

The vehicle detection system provides two main functions:

- it offers a means of detecting incidents on the Skyway and the QEW between Burlington Street and Highway 2;
- it provides a means of estimating travel times between Burlington Street and Highway 2 for both the QEW and the arterial.

On the QEW, the detector system will consist of inductance loop detectors installed in a speed sampling configuration as illustrated in Exhibit 5.1. With the spacing of detector stations it will be possible to identify incidents both by location and lane. At the detector station, volumes, occupancies and speeds will be calculated and this information will be transmitted to the control centre computer.

The primary incident detection stations are proposed for that section of the QEW between Burlington Street and Highway 2 interchange. The detector station spacing will range from 500 metres to 800 metres. The detector stations south of the Skyway through to the Burlington Street interchange were included to provide incident detection capability.

The vehicle detection system also provides a means of estimating vehicle speeds which can be then used to develop travel time estimates for input to the commuter information system.

The other element of the vehicle detection system relates to the arterial. Critical information for the arterial includes volume and travel time information between Highway 2 and Burlington Street as well as queue lengths on the approaches to the lift bridge. The volume information on the arterial will be collected through a detector station mid-way along the arterial. Queue length detector stations will be located on each approach to the lift bridge with one detector per lane. The detectors will be normally 2 m by 6 m with spacings of approximately 200 m. Assuming a discharge rate of 2.5 seconds per vehicle, this would provide a nominal indication of when the queue length will require five minutes to clear. The actual duration of the congestion will be a function both of the standing queue as well as the vehicle demand.

Another element of the vehicle detection system is that of detectors on the on/off ramps at the major interchanges. This information on traffic flows during different diversion plans as well as count data can assist in transportation planning and traffic operations.

In total, approximately 160 detectors are required for Stage 1 and a further 60 in Stage 2 of which half are replacement detectors required due to construction.

The plates in Appendix B illustrate the location of the major detector stations.

5.2.2 Closed Circuit Television (CCTV)

The closed circuit television system for the corridor is used as a means of confirming incidents and diagnosing response requirements. The CCTV camera coverage extends from the Burlington Street interchange through to the Highway 2 interchange. The cameras are located at approximate 1,400-1,600 m spacings. The cameras will have full pan, tilt, zoom and automatic iris control and focus. The cameras are to be mounted on 15 m concrete poles. The eight camera locations as illustrated on the plates in Appendix B, were determined taking into account road geometrics and elevations. Generally, the cameras provide a coverage of 700-800 m. On the Skyway, cameras are placed closer together because of visual obstructions provided by the Skyway superstructure. The cameras on the Skyway would provide an alternate means of monitoring the lift bridge and traffic conditions on the arterial.

The CCTV system would be monitored through the control centre which would include:

- monitors and demodulators for each field camera;
- a camera control unit to adjust the pan, tilt and zoom, etc.;
- a video cassette recorder to record significant events in the corridor.

[REDACTED]

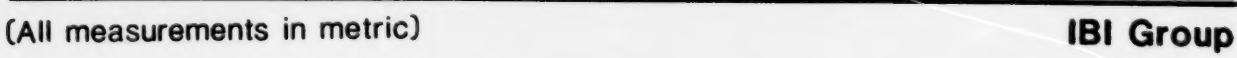


exhibit 5.2
TYPICAL MESSAGE DISPLAYS

PHASE 1

CAUTION
INCIDENT ON SKYWAY

SKYWAY CLOSED

SKYWAY
XX MIN. DELAY

LOCAL TRAFFIC
USE ARTERIAL

PHASE 2

RIGHT LANE CLOSED

USE ARTERIAL

ARTERIAL
XX MIN. DELAY

5.2.3 Changeable Message Sign

The changeable message signs provide the primary source of real-time information to motorists in the corridor. Eight sign locations have been identified: four for northbound and four for southbound traffic. The northbound locations are on the QEW in advance of the Highway 20 off ramp, the Burlington Street off ramp, the off ramp south of the Skyway and the Burlington St. off ramp in advance of the Woodward Ave. interchange.

The southbound changeable message signs will be located on the QEW in advance of the 403 interchange, on 403 for eastbound traffic in advance of the QEW interchange, on the QEW in advance of the off ramp for Highway 2, and on the collector south of the Highway 2 on ramp. The changeable message sign locations are illustrated on the plates in Appendix B.

The proposed changeable message signs will consist of letters 40-45 cm high which would be visible at distances of between 250-300 m. The changeable message signs can operate in a two-phase mode when required so that two two-line messages can be displayed in 4-5 second intervals. This combination of viewing distance and cycle time provides the capability of displaying messages to motorists.

Exhibit 5.2 provides a representative sample of typical messages that might be displayed with a two phase operation.

5.2.4 Outlying Blank Out Signs

The outlying blank out signs are used to advise the longer distance travellers of Skyway closures. This capability would basically replace an existing emergency closure procedure which involves maintenance vehicles installing tabs on sign structures at these major outlying intersections. The message on the proposed outlying signs would vary by location because they provide information on alternate routes such as:

"Skyway Closed - Use Highways 53, 20" or "Skyway Closed to Trucks".

With the Freeway Traffic Management System these outlying signs would be linked to the Freeway Traffic Management System control centre through leased telephone lines. Therefore, the operator would be able to implement the appropriate message much more quickly. This will result in a much more effective use of personnel.

Exhibit 5.3 summarizes the location of the outlying blank out signs and the respective messages that would be used.

Exhibit 5.4 indicates the location of the outlying blank out signs.

5.2.5 Blank Out Signs in Corridor

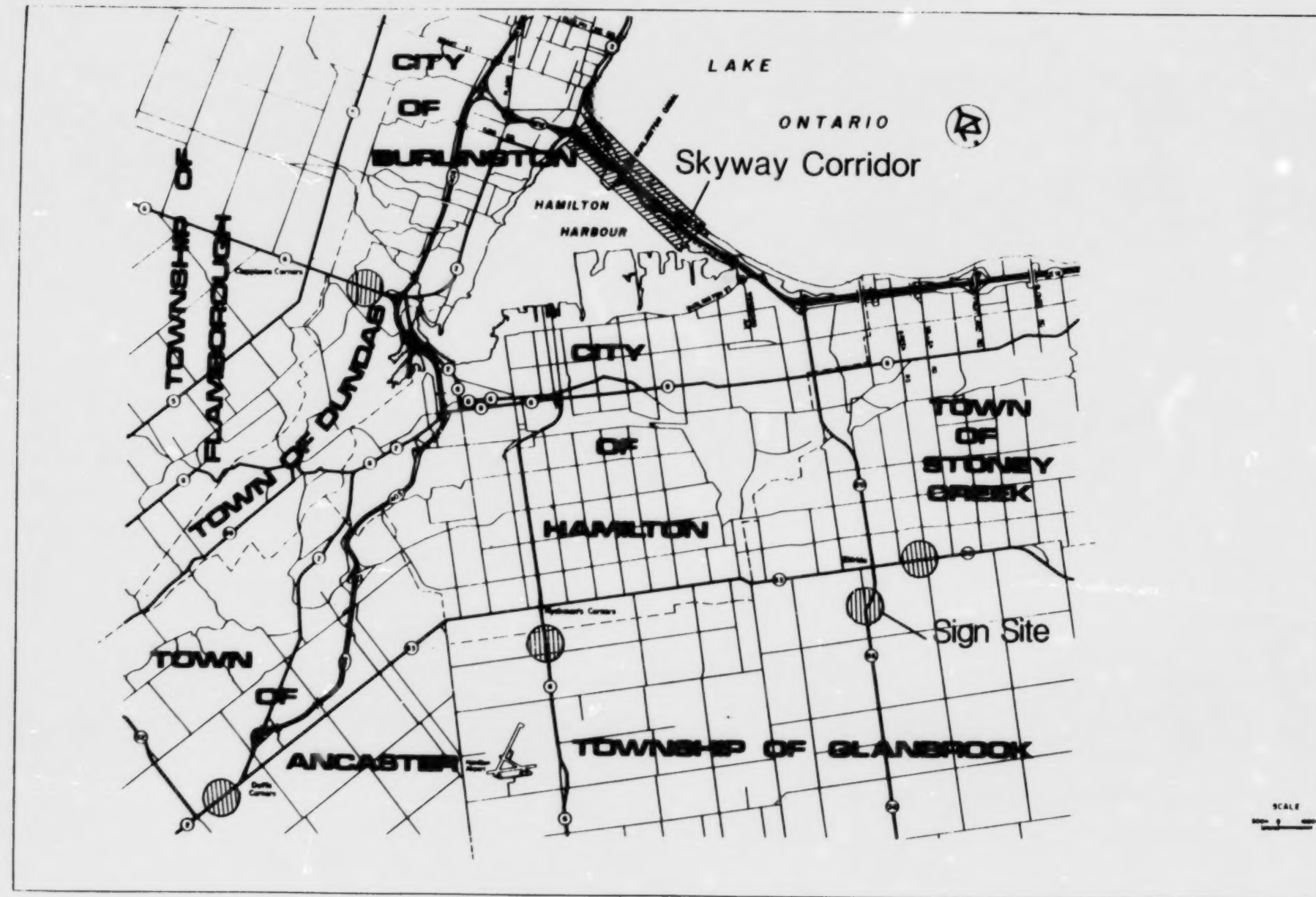
Blank out signs within the corridor will be used to restrict traffic movements at specific intersections in accordance with the requirements of a response plan. The following lists these restrictions by intersection:

- at the West Service Road and south end of Beach Blvd. two blank out signs will be actuated during diversions. Sign messages indicating "No Through Traffic" will be included for traffic westbound on Beach Blvd. and northbound on the West Service Road;
- at the intersection at West Service Road and the QEW on and off ramps south of the Skyway, three blank out signs will be installed. The blank out sign for southbound West Service Road traffic will indicate that two lanes will be used for left turns. The blank out sign for northbound traffic on the West Service Road will restrict right turn and through movements. The remaining blank out sign will restrict left turns from the QEW exit ramp.

exhibit 5.3
OUTLYING BLANK OUT SIGNS

<u>LOCATION</u>	<u>FULL CLOSURE MESSAGE</u>
Hwy. 6 Southbound North of 2	Skyway Closed Use Hwy's 403, 53, 20
Hwy. 2 Eastbound West of 53	Skyway Closed Use Hwy's 53, 20
Hwy. 6 Northbound South of 53	Skyway Closed Use Hwy's 53, 20
Hwy. 56 Northbound South of 53	Skyway Closed Use Hwy's 53, 403
Hwy. 20 Westbound East of 56	Skyway Closed Use Hwy's 53, 403

exhibit 5.4
OUTLYING BLANK OUT SIGNS



The locations of the blank out signs are illustrated in Appendix B.

5.2.6 Citizen Band Monitoring (CB)

A large number of vehicles are presently equipped with Citizen Band radio. This is especially so for commercial vehicles such as trucks. At present, the OPP monitor the designated emergency frequency channel (Channel 9) in the corridor. Certain reception problems are experienced due to the steel members of the Skyway structure, as well as the adjacent Brant Hospital which interferes with transmission and reception. To offset these problems, the Burlington Skyway system would include CB monitoring both north and south of the Skyway.

The citizen band radio coverage of the Freeway Traffic Management System will consist of four CB receivers distributed through the corridor between the Burlington Street/QEW interchange and the Fairview/QEW interchange. The emergency channel will be monitored at the control centre with no transmission capabilities.

The locations of the CB radio receivers are shown on the plates in Appendix B.

5.2.7 Local Intersection Control

The Burlington Skyway corridor will include a number of signalized intersections which are shown in Appendix B and listed below:

- the southbound off ramp on Highway 2;
- the northbound off ramp on Highway 2;
- two intersections at the Canada Centre for Inland Waters (CCIW) entrance;
- the arterial and the ramps to the QEW south of the Skyway;

- the intersection of Van Wagners Boulevard and Beach Boulevard and the on ramp to the QEW;
- the new arterial and Beach Boulevard;
- the southbound off ramp from the QEW to Woodward Avenue.

Under normal operating conditions, the intersections will operate independently as fully actuated intersections with 170 traffic signal controllers. During incidents where a diversion to the arterial is warranted, the traffic signal timing and/or signal phasing will be adjusted from the central computer to accommodate the diverted traffic.

5.2.8 Lane Control Signs

Lane control signs are proposed for the Skyway at the completion of Stage 2. These lane control signs would be spaced at 300m intervals with individual signs for each lane. These signs will be used to notify traffic through green "arrows" or red "Xs" that a lane is open or closed. Each sign will have a third symbol which would be used to indicate a truck lane or some other symbol indicating another condition such as an amber display which would advise of a lane closure transition. With these signs, traffic can safely merge. These lane control signs will be especially important during accidents but will also provide improved safety for bridge maintenance crews.

The truck lane designation is important because of the number of trucks, their slow operating speeds and the resultant impact on traffic. Moreover in high wind conditions, an additional lane may be required to provide extra space between the trucks and regular traffic.

The locations of the lane control sign structures are illustrated in Appendix B.

5.2.9 Communications Network

The communications system consists of a dedicated coaxial cable which will be buried adjacent to the QEW from Guelph Line to Burlington Street. The coaxial cable system will consist of a bi-directional trunk in a mid-split configuration with the downstream (central to remote) band width operating in the 5 MHz to 108 MHz and the upstream band width operating in the spectrum of 160 MHz to 300 MHz. This mid-split configuration allows multiple channels for video, audio communications and high speed data transmission with excess capacity for future expansion without additional cable. Exhibit 5.5 illustrates a tentative allocation of frequencies for traffic and signing data, CCTV and remote audio.

The trunk coaxial cable proposed would be armoured, flooded, .750 cable which is readily available as a standard product from cable supply companies. In some locations the cable would be directly buried and have an armoured covering; in other locations the cable would be installed without armour but in rigid or flexible duct.

The coaxial communications network can be expanded geographically simply by extending the cable, or functionally, by making more use of the available frequency spectrum.

The proposed routing of the coaxial cable is illustrated in Appendix B.

The five outlying blank out signs and the one changeable message sign south of the Highway 20 interchange will be linked to the control centre by means of leased telephone lines. This provides a more cost-effective mode of operation for these signs because of the distance from the control centre and the minimal data transmission requirements.

5.3 MODE OF OPERATION

The previously described field elements will be operated in an integrated fashion so that incidents or other problems can be identified quickly, and the necessary response determined and implemented efficiently. Complementing the hardware components are a variety of interface requirements.

5.3.1 System Interface

For the full benefits of the proposed system to be realized, it will be important that the Freeway Traffic Management System interface effectively with the MTC district operations, the OPP, and the media.

OPP

The interface with the OPP will include four TV sets to be installed in the OPP dispatch office in the Burlington detachment. These TV sets will provide the OPP a means of selecting any one of the 8 CCTV channels to monitor traffic conditions and/or incidents. On an additional channel, the OPP will be able to view media information.

An additional interface element would be a direct telephone line between the Control Centre of the Freeway Traffic Management System and the OPP dispatch office.

Lift Bridge

The interface to the lift bridge allows the lift bridge operator to advise of when the bridge will be raised and for how long. Also, the interface confirms when the bridge is closed to traffic. Lift bridge data are used to estimate travel time and delay on the arterial.

MTC Operations

The tie-in to the MTC dispatch office is especially important because of the vital role that the MTC emergency vehicles and maintenance vehicles play in identifying and responding to incidents. For example, the

exhibit 5.5

PRELIMINARY SPECTRUM ALLOCATION FOR COAXIAL CABLE

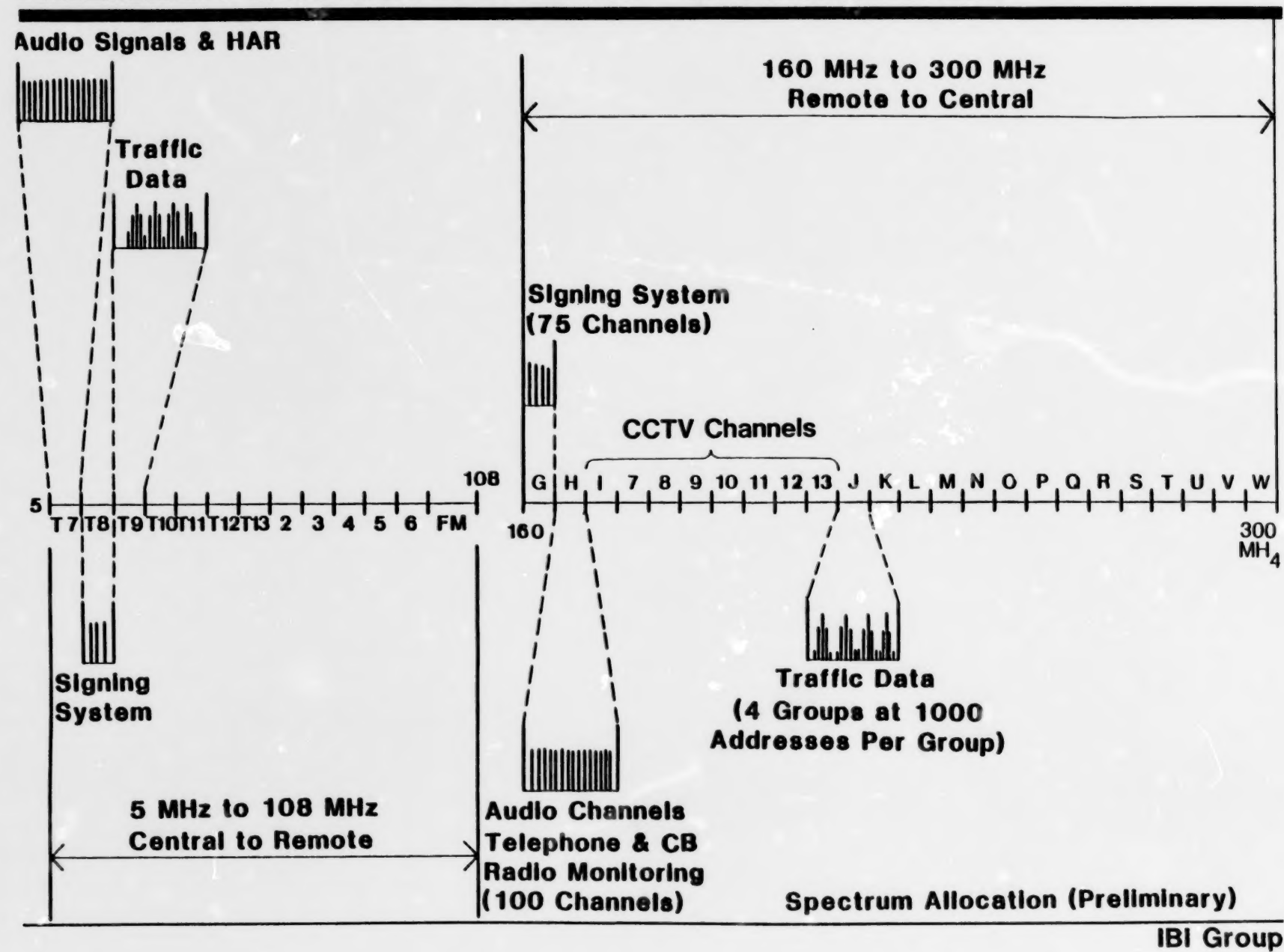
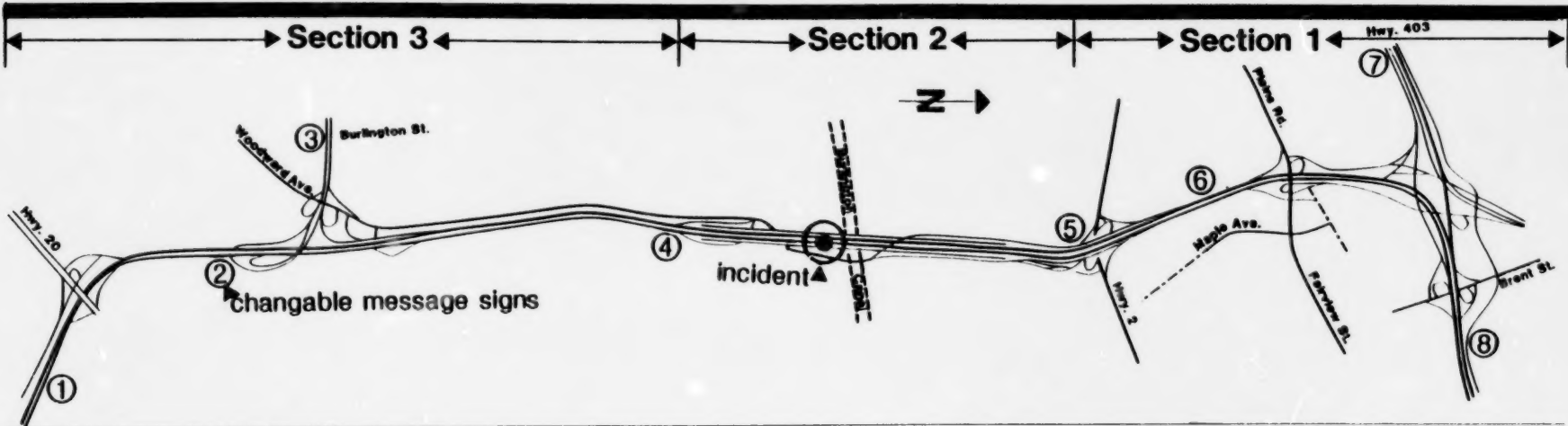


exhibit 5.6

SAMPLE STRATEGIC RESPONSE PLAN



Scenario : Burlington Skyway Blocked
northbound , section 2

Device Status :

sign ① SKYWAY BLOCKED ALL TRAFFIC MUST EXIT

sign ② SKYWAY BLOCKED ALL TRAFFIC MUST EXIT

sign ③ SKYWAY BLOCKED USE ARTERIAL

sign ④ SKYWAY BLOCKED
USE ARTERIAL NEXT EXIT

signs ⑤ to ⑧: NULL MESSAGE

lane control signals INDICATE ALL LANES CLOSED
ON SKYWAY NB

arterial traffic signals LONGER GREEN TIMES FOR THROUGH TRAFFIC

existing MTC patrol vehicles presently identify approximately 30% of the lane blocking incidents on the Skyway. Furthermore, these vehicles have the capabilities of removing vehicles or clearing incidents so that traffic flow can be re-established quickly and efficiently. Because of the importance of this interface, the Control Centre design includes dispatcher facilities so that the MTC dispatcher and the FTMS Control Centre operator can communicate directly.

Media

The Burlington Skyway is a major transportation link for media traffic reporting. With improved information on the Skyway and the Corridor, the media equipment (e.g. helicopters) could be deployed in other areas so that there is more comprehensive information on an area wide basis. The proposed interface to the media would involve the FTMS operator keying in a message which would then be broadcast by Bell telephone to receiving equipment in radio or newspaper news rooms. However the critical link would be to radio stations providing traffic information. This would be especially important to the longer distance travellers who could be advised of problems prior to entering the corridor.

5.3.2 System Response Capabilities

The full capabilities of the field detection and response elements can only be achieved if they are integrated as part of strategic response plans. Exhibit 5.6 provides an example of a strategic response plan for a major incident northbound on the Skyway. As illustrated by the exhibit, the changeable message signs, the lane control signs and the West Service Road traffic signals would all have predetermined responses for this type of incident. The incident itself could either be detected by the incident detection algorithm or called up by the Control Centre operator based on other input (e.g. OPP, MTC emergency vehicle, CCTV, etc.). Having identified the problem, the response plan would then be presented by the system to the Control Centre operator who would then follow one of a number of possible actions which could include:

- no response pending the availability of further information or confirmation in the event that the incident was detected by the incident-detection system;

- implementing the full response plan as determined;
- implementing on a selected and manual basis individual field element responses (e.g. calling up or inputting a specific message on a specific sign).

The operator would continue to monitor the situation and, as appropriate, revise or update the response plan. With this approach, it will be necessary to develop a wide range of response plans for certain selected and high probability incidents. It is conceivable that between 40 and 50 strategic plans could be identified and preprogrammed.

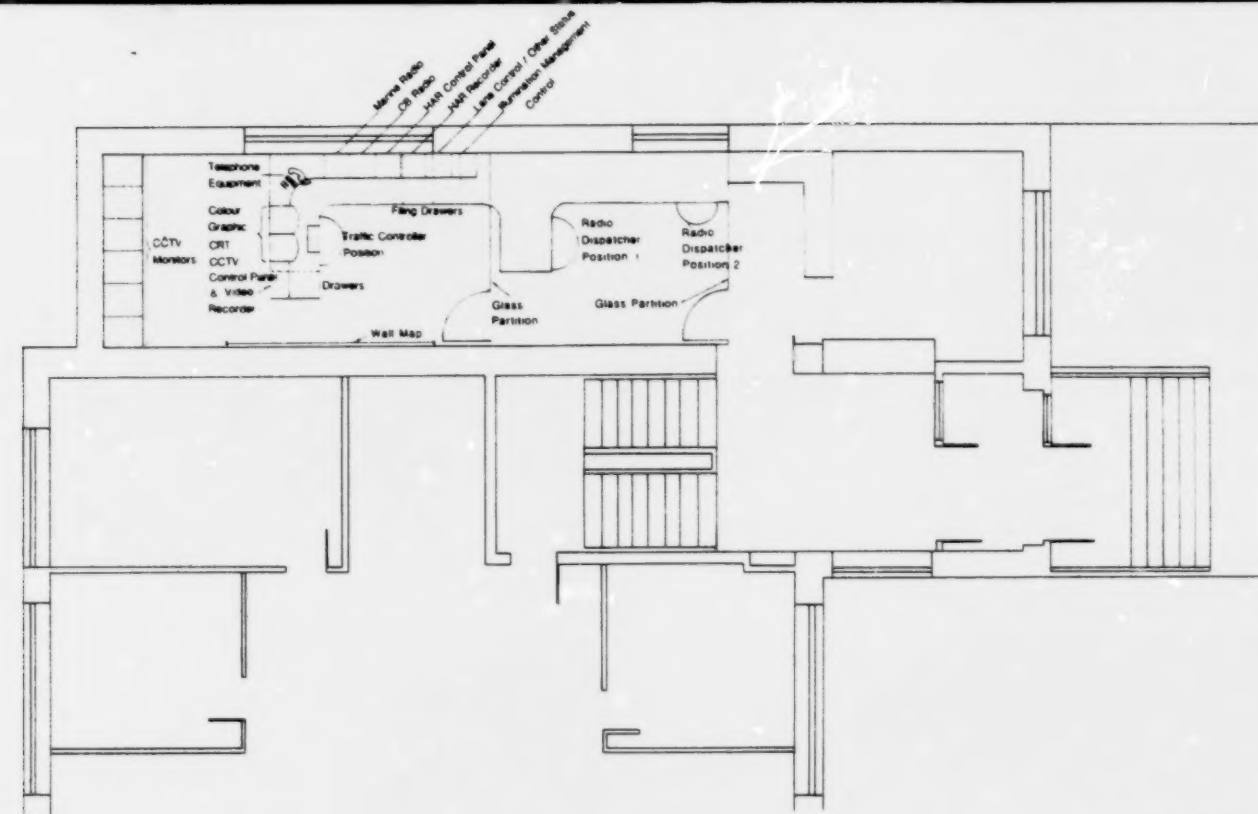
The commuter information system will include detailed travel time comparison data for the two commuter routes: the QEW between Burlington Street and Highway 2 and the new arterial between Burlington Street and Highway 2. Because of the unknowns related to the quality of the information to be provided to the commuter and the impact on commuting characteristics, flexibility is being maintained in the system to provide a wide range of information to the commuters. For example, the message could be very limited such as "lift bridge down", or very comprehensive involving travel time comparisons between the two routes or estimates of the delay by each of the two routes. In any event, the more detailed information will be gathered and made available to the Control Centre operator who will be able to select a commuter advisory response.

5.3.3 Control Room

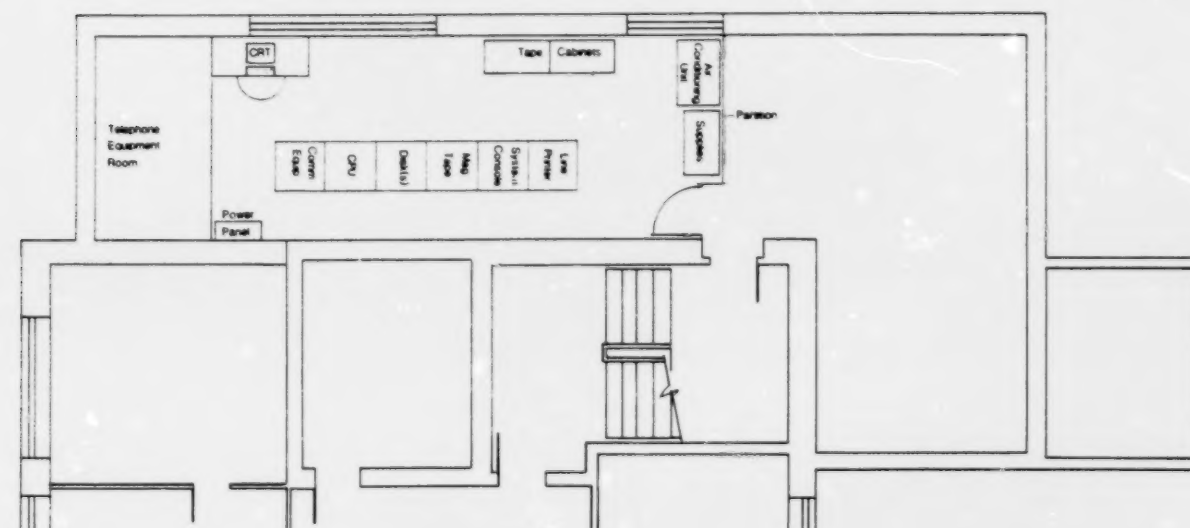
The Freeway Traffic Management System Control Centre will consist of a controlled-environment computer room to house the computer and all other peripheral devices, and an operators' Control Room which will house all of the operator interface devices. These devices include:

- eight CCTV monitors;
- two CRT's to provide graphic illustrations on the operating characteristics of the corridor and the interface to the overall system including the changeable message signs;

exhibit 5.7
CONTROL ROOM



Main Floor
 Scale 1/4" = 1'



Lower Level
 Scale 1/4" = 1'

- the control panel for the cameras and the VCR;
- the marine band radio monitoring equipment;
- the illumination management control and monitoring equipment;
- CB radio receiver.

Exhibit 5.7 illustrates the arrangement of the equipment in both the operators' Control Room and the Control Centre Computer Room.

The Control Rooms are to be located in the MTC District Office in Hamilton. The radio dispatch room adjacent to the Control Room is integrated into the Control Room design but the services and responsibilities of the operator are not expected to change.

Exhibit 5.8 provides a summary of the control equipment.

5.3.4 Software

The integration of the field and Control Centre equipment is in large part achieved through the system software. Exhibit 5.9 provides a schematic presentation of the software. It will be designed for 24 hour per day, 7 day per week, continuous operation. Also, it will include date, and time of day and system status changes so that summary status and operation reports can be obtained automatically or on request for all periods of system operation.

The system can be subdivided into two major subsystems, a real time communication subsystem and a higher level functional subsystem.

Communications

The communications software will be designed to handle the various types of communications between the central computer and other equipment. The basic functions of the communications system will be to provide data formatting, multiplexing and demultiplexing functions, communications

diagnostics and their handling. The communications testing will involve communications software to detect communications errors and to indicate the proper system response in the event of an error. These tests are conducted on input data to identify nil response or invalid data transmitted from a remote unit.

As part of the communications testing, parity checking is generally used to identify invalid data. In the event that an error is detected, invalid data is flagged so that it is not used by other routines and if consecutive communications errors are identified, a communications failure is declared and the operator notified. The major data transmission elements of the Freeway Traffic Management System relate to the volume and occupancy detectors, the CCTV control commands, the lane control sign commands, the critical traffic signal controls, the lift bridge sensors and data, and the blank out signs. Communications between the central computer and the remote hardware generally will occur once per second.

Changeable Message Signs

The changeable message sign software will form a two-level structure. In the main computer, changeable message sign messages will be identified as part of response plans. When a response plan is to be implemented, the central computer will identify the message and sign location to the CMS controller. The central CMS controller will communicate with the field equipment. This feature offers a backup in the event that the central computer is down. In addition, the software will provide for monitoring data received by each sign and the actual state of each sign will be reported to the Control Centre.

Vehicle Detection

The vehicle detectors in the system will be used to identify incidents, queue lengths and travel time for both the incident detection and commuter information system.

exhibit 5.8

BURLINGTON SKYWAY SYSTEM - Proposed System Layout

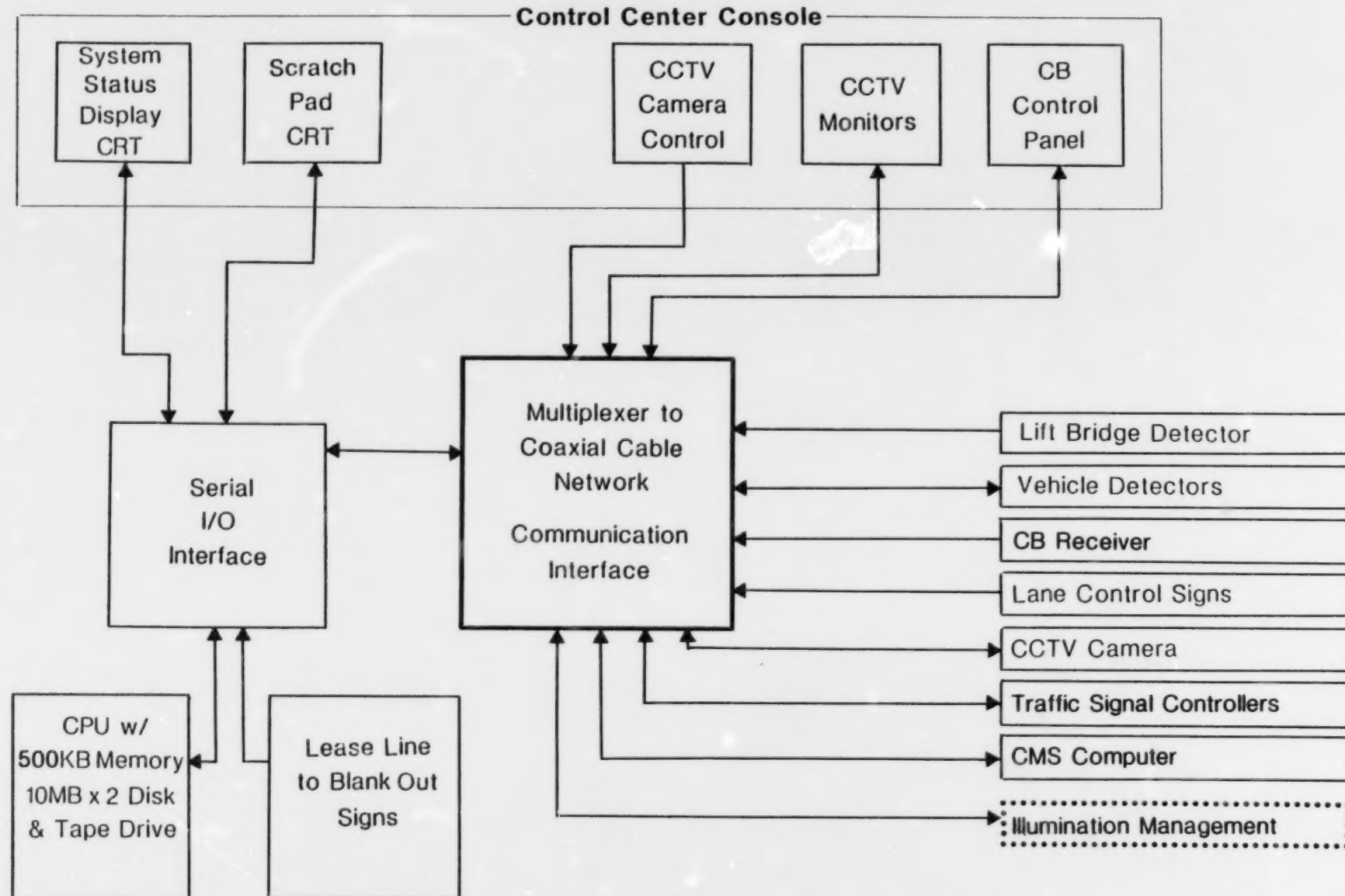
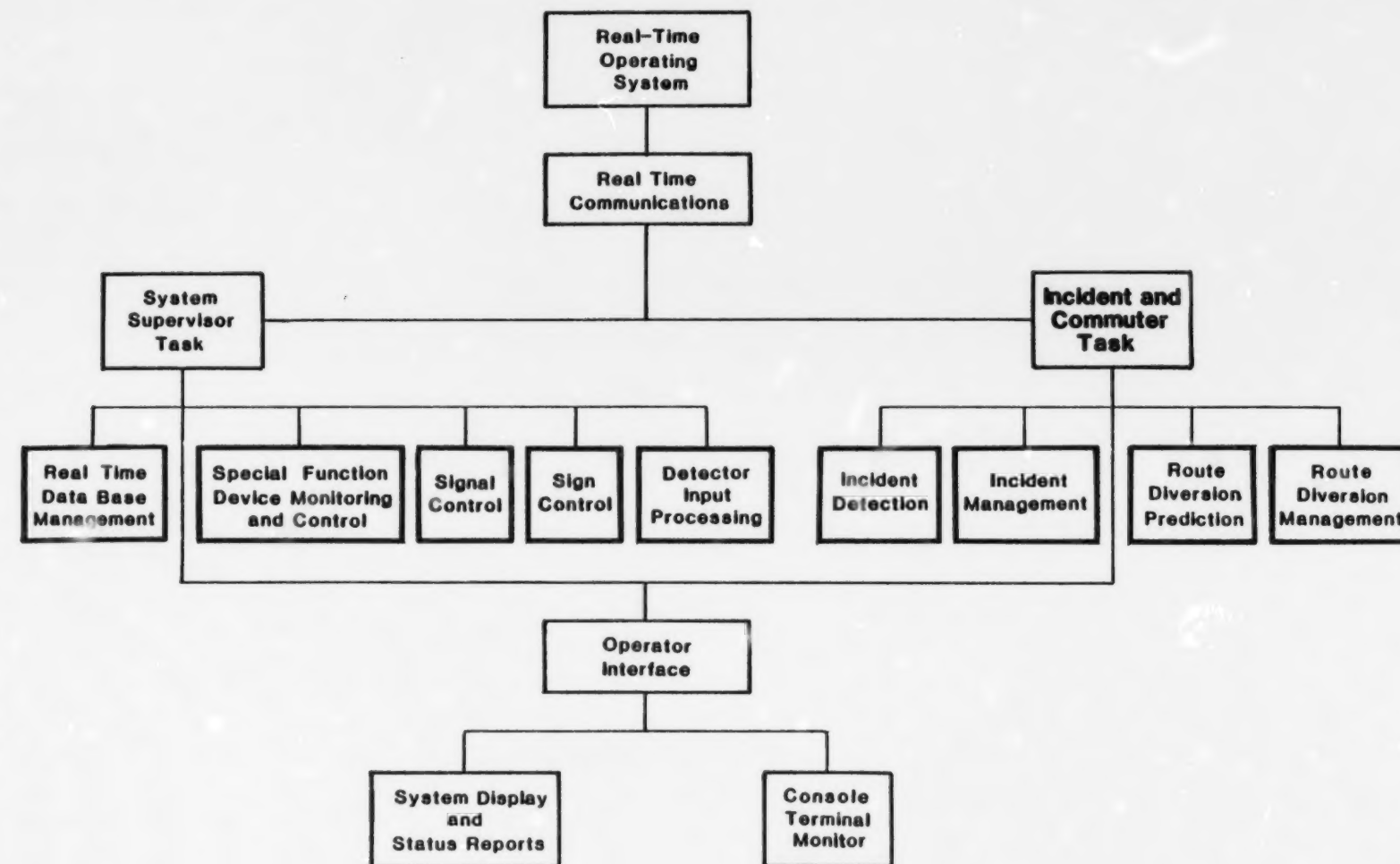


exhibit 5.9
SOFTWARE STRUCTURE



The software for the system would include a real time data base management system. Traffic volume, occupancy and speed data would be maintained on data files for use by the various system monitoring, control and report writing routines.

Incident Detection

The incident detection software for the system would utilize various incident-detection algorithms and a lane-determination algorithm. All incident-detection algorithms will run concurrently on a once per minute basis during periods of normal operation. The user can input parameters and one or more of the incident-detection algorithms can be inhibited.

Once an incident is identified and confirmed, the response plan would be prepared and presented to the operator. The operator would then have the option of approving, changing or cancelling the response plan.

Lift Bridge Interface

The lift bridge interface software would consist of a library of records on pleasure craft activities. Based on this historical data, predictions would be made as to timing and duration of anticipated lifts. This prediction would be forwarded to the lift bridge control centre where the bridge operator would be prompted and requested to confirm or clarify this information. This data once received at the Freeway Traffic Management Control Centre would then be used in the travel time prediction algorithm to assess the relative travel times on the QEW and the arterial. The lift bridge operator will be expected to notify FTMS operator of timing and duration of commercial ship lifts.

Operator Interface

An important element of the software is the interface between the operator and the system. A primary input would be through the CRT's in the control centre. In the majority of cases, the operator would input data or commands. Two of the primary output devices would be a printer and a CRT display. The printer would be used for summary reports. The CRT display

5

would provide the bulk of the responses required by the system operator and would include such things as current status information on all field equipment, and graphical displays of the freeway operating condition.

The proposed software would be dimensioned to allow for possible future ramp metering. Although ramp metering is not a feature at this point, the ultimate control area for the Freeway Traffic Management System may include locations where ramp metering would be appropriate.

The software would also provide the means of instituting control and monitoring other field equipment devices including traffic signals, blank out signs, CB receivers, HAR transmissions, etc.

5.4 ILLUMINATION MANAGEMENT

Provisions are being made in the Freeway Traffic Management System software to provide traffic volume data to the illumination management system. This traffic volume data will be summarized in an appropriate format by time interval and geographical area. As presently configured, there are to be three geographical areas roughly defined as the areas, north of the Skyway, the Skyway, and the area south of the Skyway on/off ramps.

5.5 RIGHT-OF-WAY REQUIREMENTS

There are a number of pieces of equipment to be installed which could have an impact on highway rights-of-way including:

- changeable message signs and structures;
- cameras and poles;
- blank out signs;
- cabinets;
- coaxial cable.

Based on a layout of field equipment as illustrated in Appendix B, no additional right-of-way is anticipated other than that which will be provided as part of the roadwork contracts.

5.6 UTILITIES

Because of the nature of the Freeway Traffic Management System, there are no relocations of existing utilities anticipated. During the installation of the Freeway Traffic Management System it will be important to coordinate with the local utilities.

5.7 RAILWAYS

There is at present one rail line in the corridor. This railway is to be removed from the corridor and the lift bridge thereby providing for four traffic lanes on the lift bridge as part of the reconstruction effort for the new arterial.

6. BENEFITS

There are a wide variety of benefits associated with the Freeway Traffic Management System. Some of these benefits have been quantified and include reduced delay and congestion as a result of the quick identification and clearance of incidents, reduced congestion due to effective traffic rerouting and reduced accidents. Qualitative benefits are also important and these can include instituting diversions more effectively and with less manpower, and improved safety for maintenance crews.

6.1 QUANTIFIED BENEFITS

In developing quantified benefits for the proposed Freeway Traffic Management System on the QEW/Burlington Skyway corridor, the emphasis was on incident detection, response and clearance. Based on the proposed system, it was estimated that the overall average duration of incidents would be reduced by approximately 4 minutes. Estimates of average annual vehicle delays were prepared by incident type for the existing situation and when a Freeway Traffic Management System would be in place taking into account incident rates and traffic volumes by time of day. The technique used to estimate these delays is described in Appendix A.

Exhibit 6.1 provides a summary of the estimated vehicle hours of delay before and after the implementation of the Freeway Traffic Management System. As illustrated in the exhibit, reduction in delay was calculated based on reduced durations for both accidents and incidents but no delay benefits for maintenance activities.

As summarized in the exhibit, the largest potential savings in annual vehicle hours of delay are in Stage 1 where an estimated 330,000 vehicle hours would be saved per year.

In estimating the reduction in vehicle hours of delay for Stage 2, it was necessary to estimate the number of accidents and vehicle breakdowns that would be expected with the completion of the new Skyway. This was done on the basis of a projection of traffic volume and related accidents and vehicle breakdowns. The estimate of vehicle delays in Stage 2 took into account the increase in roadway capacity.

Exhibit 6.1 points out that the annual savings in vehicle hours of delay would be approximately 330,000 in Stage 1 and 143,000 in Stage 2. These reductions in delay can be translated to benefits as reflected in dollars based on accepted values of time, fuel consumption rates, and commercial vehicle costs. Based on information provided by the Transportation Capital Branch the average auto occupancy rate in the corridor was estimated at 1.4 persons per vehicle based on a weekday rate of 1.2 persons per vehicle and a weekend/holiday rate of 2.0 persons per vehicle. The weighted average value of time was estimated to be \$3.20 based on work trip demand accounting for 45% of total demand with an associated value of \$5.42 and the remaining person trips having an hourly rate of \$1.36 per person. This translates into an average vehicle hour cost of approximately \$4.48. This resultant rate would only apply to that proportion of the traffic (approximately 80%) that is personal or private automobiles.

Based on actual counts, commercial or truck traffic accounts for 20% of the demand in the corridor. The average hourly cost of these vehicles is approximately \$21.80.

Fuel costs are also estimated based on a fleet average of 3.2 litres per hour of delay.

Exhibit 6.2 summarizes the expected benefits of the proposed Freeway Traffic Management System for Stage 1 and Stage 2. The total annual quantified benefits as reflected in dollars is approximately \$2.7 million per year in Stage 1 and \$1.2 million per year in Stage 2. In addition, the system would yield significant reductions in carbon monoxide, hydrocarbons and nitrous oxides.

6.2 NON-QUANTIFIED BENEFITS

There a large number of non-quantified benefits of the system which include:

- the ability to institute diversions quickly, making efficient use of available manpower;
- a motorist information system which would allow motorists to make diversions in the event of major incidents which should reduce their overall travel time;
- the motorist information system which will result in reduced accidents, thereby improving safety for the travelling public;
- the field equipment of the proposed system and most especially the traffic detectors should provide improved data on traffic flow in the corridor. This can be used for planning or traffic operations purposes and monitoring of diversion plans;
- the commuter information system should reduce the volume on the Skyway during critical periods thereby reducing the unstable flow conditions and extending the effective operating period of the existing Skyway.

The quantified benefits are significant but were based on a very conservative estimate and do not include accident benefits or savings attributable to diversions.

exhibit 6.1

**ESTIMATED REDUCTION IN DELAY
DUE TO SYSTEM IMPLEMENTATION**

STAGE 1	VEHICLE-HOURS DELAY BEFORE	VEHICLE-HOURS DELAY AFTER (4 MIN. REDUCTION)	VEHICLE-HOURS BENEFIT
ACCIDENTS	527,170	393,150	134,020
BREAKDOWNS	944,050	746,260	197,790
TOTAL :			331,810

STAGE 2	VEHICLE-HOURS DELAY BEFORE	VEHICLE-HOURS DELAY AFTER (4 MIN. REDUCTION)	VEHICLE-HOURS BENEFIT
ACCIDENTS	239,770	184,900	54,870
BREAKDOWNS	420,430	331,730	88,700
TOTAL :			143,570

IBI Group

exhibit 6.2

QUANTIFIED BENEFITS

BENEFIT ITEM	BENEFITS IN DOLLARS/ANNUM
<u>STAGE 1</u>	
Benefits:	
Person	\$1,272,900
Fuel	310,030
Commercial Vehicle	<u>1,182,710</u>
TOTAL	\$2,765,640
Emissions:	
CO	360,180 Kg
HO	25,830 Kg
NOX	8,070 Kg
<u>STAGE 2</u>	
Benefits:	
Person	\$ 514,550
Fuel	133,160
Commercial Vehicle	<u>561,390</u>
TOTAL	\$1,209,100
Emissions:	
CO	158,580 Kg
HO	10,440 Kg
NOX	3,260 Kg

IBI Group

7. LEGAL AGREEMENTS AND COST SHARING

7.1 LEGAL AGREEMENTS

There are two legal agreements that would have some bearing on the operation of the Freeway Traffic Management System: one agreement with Public Works Canada regarding the interface to the lift bridge and one with the City of Burlington regarding the interfaced traffic signals on Highway 2.

Public Works Canada and the Ministry of Transportation and Communications have entered into an agreement whereby the Ministry will resume financial responsibility for the re-construction costs for the lift bridge. The agreement also makes provisions for the future lift bridge interface to the Freeway Traffic Management System which is to include relay contacts to monitor bridge positions and an interface panel in the lift bridge operator's Control Room. The latter will be used by the lift bridge operator to advise the Freeway Traffic Management System operator of anticipated lifts and their duration.

An agreement with the City of Burlington will relate to the procedures by which the Ministry through the Freeway Traffic Management System will take pre-emptive control of the traffic signals along Highway 2.

7.2 COST SHARING

There is no expected cost sharing on the Burlington Skyway Freeway Traffic Management System.

8. COST ESTIMATE

8.1 CAPITAL COSTS

The capital cost estimates were prepared for the proposed Freeway Traffic Management System for both Stage 1 and Stage 2. These costs are summarized in Exhibit 8.1.

The largest single cost item in Stage 1 is that of field equipment and field electronics. The field equipment is estimated to cost \$2,000,000. This field equipment includes all field electronics and electrical work for changeable message signs, cameras, detectors, communications systems, etc.

The software is estimated to cost \$500,000. This includes both communications and higher level software that deals with the functional elements of the system.

The control room equipment is estimated to cost \$225,000 including approximately \$150,000 for computer peripheral devices. An additional \$75,000 is set aside for other control room equipment such as TV monitors, control room furniture, switching equipment, etc.

The building renovations and services for the control rooms are estimated to cost \$120,000. This is to include the cost of replacing the existing board room in the District 4 offices.

The Stage 2 costs are estimated at an additional \$429,000 with the largest amount being \$300,000 for lane control signs on the new and refurbished structures. Approximately \$30,000 is required in Stage 2 for detectors on the QEW; approximately half of these detectors are replacements for detectors that would be lost as part of the reconstruction program.

exhibit 8.1 COST ESTIMATES

	QUANTITY	UNIT COST	TOTAL COST
<u>STAGE 1</u>			
<u>CONTROL ROOM EQUIPMENT</u>	Lump Sum		\$ 225,000
<u>BUILDING RENOVATIONS AND SERVICES</u>			
Control Room	Lump Sum		\$ 120,000
<u>FIELD EQUIPMENT</u>			
Changeable Message Signs (Including Structures)	8	\$ 95,000	760,000
Changeable Message Sign Controller	1	60,000	60,000
Cameras	8	21,500	172,000
Camera Poles	8	3,000	24,000
CB Radio Receivers	4	2,000	8,000
Special Signs	8	5,000	40,000
Detectors - Arterial	24	1,000	24,000
Traffic Signal Connect	8	5,000	40,000
Communications Network	Lump Sum		564,000
Traffic Cabinets	40	2,000	80,000
Communications Pedestals	26	1,000	26,000
Duct	3,050 m.	16.4	50,000
Detectors - QEW	68	1,000	68,000
- Arterial	8	1,000	8,000
- Ramps	52	1,000	52,000
Sub-Total Field Equipment			\$1,976,000
<u>SOFTWARE</u>	Lump Sum		500,000
TOTAL - STAGE 1			\$2,821,000
<u>STAGE 2</u>			
<u>LANE CONTROL SIGNS</u>	12	25,000	\$ 300,000
<u>DETECTORS</u>	30	1,000	\$ 30,000
<u>CALL BOXES</u>	40 + 26	1,500	\$ 99,000
TOTAL ADDITIONAL STAGE 2 COSTS			\$ 429,000
TOTAL CAPITAL STAGE 1 AND 2			\$3,250,000
ENGINEERING (20%)			\$ 650,000
TOTAL			\$3,900,000

It is estimated that the telephone call boxes will cost \$99,000. However, no commitment is being made for the installation of these until the results of the monitoring program during initial Stage 1 period are known.

The total capital cost for the proposed Freeway Traffic Management System (Stages 1 and 2) is approximately \$3.25 million. Based on the engineering and contingency amount of 20%, the overall capital expenditure would amount to approximately \$3.90 million.

8.2 OPERATING COSTS

It was estimated that the operating and maintenance costs would amount to approximately 10% of the capital expenditure. Thus for the proposed system, this would amount to approximately \$399,000 per year. This is probably high in that it is calculated on a base which includes the 20% engineering and contingency fee. To place this in context though, it is estimated that a 24 hr/day operation, 365 days/year would require operators with an annual cost of \$156,000 per year. This would provide approximately \$243,000/year for maintenance.

8.3 BENEFIT COSTS ASSESSMENT

The above described capital costs were amortized for both Stage 1 and Stage 2. For Stage 1, it was assumed that capital costs, including engineering and contingencies, would be written off over a seven year period at a real interest rate of 10% per annum. This would result in an annual capital cost of approximately \$700,000 which, when combined with the estimated operating costs of \$350,000, would result in an annual cost of \$1.050 million. Taking into account the estimated benefits described in Chapter 6, the resulting benefit/cost ratio of the Stage 1 program would be approximately 2.6. The Stage 1 costs were written off over a seven year period assuming this would be the time between the completion of Stage 1 and the completion of Stage 2.

The Stage 2 capital costs were written off over a ten year period reflecting the economic life for a system of this nature. This resulted in a capital cost per year of approximately \$70,000 and an annual maintenance and operating costs per year of \$399,000. The resulting annual costs per year compares to an annual benefit of approximately \$1.2 million for a benefit/cost ratio of approximately 2.6.

The benefit cost assessment is summarized in Exhibit 8.2.

exhibit 8.2

BENEFIT COST ESTIMA

STAGE 1

ANNUAL COSTS

Annualized Capital Costs
(10% Discount Rate, 7 Years)

Annual Maintenance and
Operating Costs

Total Annual Cost

ANNUAL BENEFITS

BENEFIT COST RATIO

STAGE 2

ANNUAL COSTS

Annualized Capital Costs
(10% Discount Rate, 10 Years)

Annual Maintenance and
Operating Costs

Total Annual Cost

ANNUAL BENEFITS

BENEFIT COST RATIO

TE

\$ 700,000

\$ 350,000

\$1,050,000

\$2,765,640

2.6:1.0

\$ 70,000

\$ 399,000

\$ 469,000

\$1,209,100

2.6:1.0

9. CONTRACT BREAKDOWN

Contracts were developed for the detail design and installation of the Freeway Traffic Management System taking into account a number of considerations including:

- the functional elements involved in designing and implementing the system. These elements range from interior design and architectural work in renovating the control centre, to preparing field contracts for the supply and installation of field equipment, to the supply and installation of computer hardware etc.;
- the timing of the various roadwork projects within the corridor;
- the ability of contractors to effectively provide necessary services;
- annual capital construction budget limitations.

Four major functional contract areas were identified as follows:

- the construction of a control centre including the proper environment to house computer equipment and an operator's area. This was identified as a separate contract activity because it requires construction skills that are different from the other projects and it can be undertaken and completed independently although it must precede the supply and installation of the computer equipment;
- the supply and installation of the computer hardware is independent of other activities. This approach provides a means of acquiring the necessary hardware to coincide with the completion of Stage 1 road construction. Also, this is a very specialized area and quite unique from various other project areas;
- the development of the system software. This is quite unique as compared to the other areas of the project. Also, the final installation of the computer system software involves system integration which includes integrating the various pieces of field equipment, the computer hardware and the system's software;

- field contracts which also include supplying and installing associated control centre devices such as CCTV monitors.

The field contracts were broken down by geographic area taking into account the roadwork contracts underway in the corridor. The field contract breakdown is as follows:

- Contract #1: the first phase involves the Burlington Skyway Freeway Traffic Management System between Highway 2 and the on/off ramps south of the Skyway. With this system, it would be possible to divert the traffic around the Skyway in the event of an incident;
- Contract #2: the extension of the field equipment north to Guelph Line and south to Burlington Street on the QEW. This extension tied in to the completion of roadwork in each of the respective areas;
- Contract #3: the twinning of the Skyway. Once the Skyway is twinned, additional equipment will be in place on the bridges which will be used to detect incidents and provide advisory information to motorists.

Future contracts might include revisions to the field contracts reflecting road expansion north and south of the Skyway as well as future expansion of the Burlington Skyway Freeway Traffic Management System beyond the initially defined limits.

APPENDIX A

BURLINGTON SKYWAY Freeway Traffic Management System

PROCEDURE FOR ESTIMATING BENEFITS

APPENDIX A

PROCEDURE FOR ESTIMATING BENEFITS: DETERMINATION OF THE VEHICLE-HOURS OF DELAY PER INCIDENT

Introduction

The procedure outlined herein describes the analysis of traffic delay used in estimating the benefits of the Freeway Traffic Management System. The product of this analysis is shown in Exhibits A-1 and A-2. The numbers shown in each cell represent the vehicle hours of delay associated with an incident and are dependent on:

1. the severity of the traffic disturbance (i.e. one lane or full closure);
2. the duration of the traffic disturbance (i.e. the sum of incident detection, confirmation and clearance times);
3. the volume of traffic in vph.

Summaries were made of existing incident experience broken down according to the 3 variables described above. Then, the number of incidents was extrapolated into the future and an estimate made of the number of incidents per year (an average value was taken for the 7 year life of Stage 1 and the 10 year design life of Stage 2) corresponding to each cell in Exhibits A-1 and A-2. For Stage 2, 3 tables corresponding to 1, 2 and 3 lane closures were prepared similar to Exhibits A-1 and A-2 shown for Stage 1 incidents.

Thus, with both the number of incidents occurring in, and the vehicle hours of delay associated with, each cell in Exhibits A-1 and A-2 the total vehicle hours of delay per year was calculated. This total was then revised to reflect a shortened incident traffic disturbance time if a Freeway Traffic Management System were introduced. It was estimated that a 4 minute savings in incident confirmation time would accrue from the system installation (refer to Chapter 2 for an explanation of the derivation of the 4 minutes time savings).

A 1

The estimated vehicle hours of delay saved per year were then valued according to fuel savings, commercial vehicle time savings (based on an observed 20% distribution) and passenger time savings. Savings associated with accident reduction, detouring and improved safety during maintenance activities were not included in the dollar value of benefits.

Equations & Assumptions

The kinematic wave theory was used in this analysis. Two basic assumptions regarding traffic flow were made in order to determine the rates at which queues develop and dissolve. Then, using the product of the number of vehicles forming the queue (this number being related by the traffic density to length of the queue) and the duration of the tie-up, the total delay caused by an incident was calculated.

Assumption #1: that traffic flow can be modeled by a simple equation relating the volume of traffic, the vehicle spacing and the vehicle speed. The classical functional form shown as equation 1 was slightly modified to produce equation 2, which better simulates the observed conditions on the QEW.

classical $Q = V \cdot K$

... 1

where Q = flow vph
 V = speed mph
 K = density vph

revised $Q = V_f \cdot \exp^{-1/2(k/k_m)^2} \cdot K$

... 2

where V_f = free flow speed mph
 K_m = density at lane capacity
 Q, K = as before

The relationship of volume and density predicted by equation 2 is shown in Exhibit A-3. The slope of a line drawn through the origin to any point on the locus of points determined by equation 2, is the speed at that point.

EXHIBIT A-1
TRAFFIC DELAYS FOR FULL CLOSURE

Traffic Volume	Summary Details of Tie-up	Tie-up Duration (mins)				
		5	10	20	30	60
		TD ₁ = 0.028 TV ₁ = 0.167 AD ₁ = 0.167	TD ₂ = 0.111 TV ₂ = 0.333 AD ₂ = 0.333	TD ₃ = 0.444 TV ₃ = 0.567 AD ₃ = 0.067	TD ₀ = 1.00 TV ₀ = 1.00 AD ₀ = 1.00	TD ₄ = 4.00 TV ₄ = 2.00 AD ₄ = 2.00
2,650 (2 hrs) [a.m. & p.m. peak]	Veh. Hrs.Delay No. of Veh. Delay/Veh. (Min)	150 1,730 5.17	595 3,460 10.3	2,330 6,910 20.7	5,358 10,372 31.0	21,032 20,744 62.0
2,500 vph [Midday]	Veh. Hrs.Delay No. of Veh. Delay/Veh. (Min)	152 3,585 2.67	602 7,170 5.33	2,410 14,340 10.7	5,422 21,510 16.0	21,688 43,020 32.0
2,000 vph [Midday]	Veh. Hrs.Delay No. of Veh. Delay/Veh. (Min)	28.3 677 2.50	112 1,353 5.00	448 2,686 10.0	1,011 4,059 14.9	4,040 8,120 29.9
1,500 vph [Base]	Veh. Hrs.Delay No. of Veh. Delay/Veh. (Min)	12.0 287 2.50	47.7 574 5.00	191 1,150 10.0	430 1,721 15.0	1,720 3,440 30.0
500 vph [Evening]	Veh. Hrs.Delay No. of Veh. Delay/Veh. (Min)	2.34 51.1 2.72	8.61 102 5.14	37.1 205 10.9	83.6 307 16.3	334 614 32.6

TD_i - Total Delay Factor - Factor used in estimating the vehicle hours of delay for various tie up durations as compared with that calculated for a 30 minute delay (i = 0).

TV_i - Total Vehicles Factor - Factor used in estimating the number of vehicles affected for various tie up durations as compared with that calculated for a 30 minute delay (i = 0).

AD_i - Average Delay Factor - Factor used in estimating the average delay per vehicle for various tie up durations as compared with that calculated for a 30 minute delay (i = 0).

EXHIBIT A-2

TRAFFIC DELAYS FOR PARTIAL CLOSURE

Traffic Volume	Summary Details of Tie-up	Tie-up Duration (mins)				
		5	10	20	30	60
2,650 (2 hrs) [a.m. & p.m. peak]	Veh. Hrs Delay No. of Veh. Delay/Veh. (Min)	116 1,650 4.18	459 3,290 8.37	1,840 6,580 16.7	4,130 9,870 25.1	16,500 19,700 50.2
2,500 vph [Midday]	Veh. Hrs Delay No. of Veh. Delay/Veh. (Min)	70.0 2,420 1.72	283 4,890 3.47	1,110 6,690 6.87	2,500 14,540 10.8	10,000 29,100 20.6
2,000 vph [Midday]	Veh. Hrs Delay No. of Veh. Delay/Veh. (Min)	17.4 578 1.80	69.0 1,157 3.60	276 2,310 7.20	621 3,470 10.8	2,480 6,940 21.6
1,500 vph [Base]	Veh. Hrs Delay No. of Veh. Delay/Veh. (Min)	6.38 188 2.02	25.3 376 4.03	101 753 8.07	228 1,129 12.1	912 2,260 24.2
500 vph [Evening]	Veh. Hrs Delay No. of Veh. Delay/Veh. (Min)			< < <	0 6 0.1	> > >

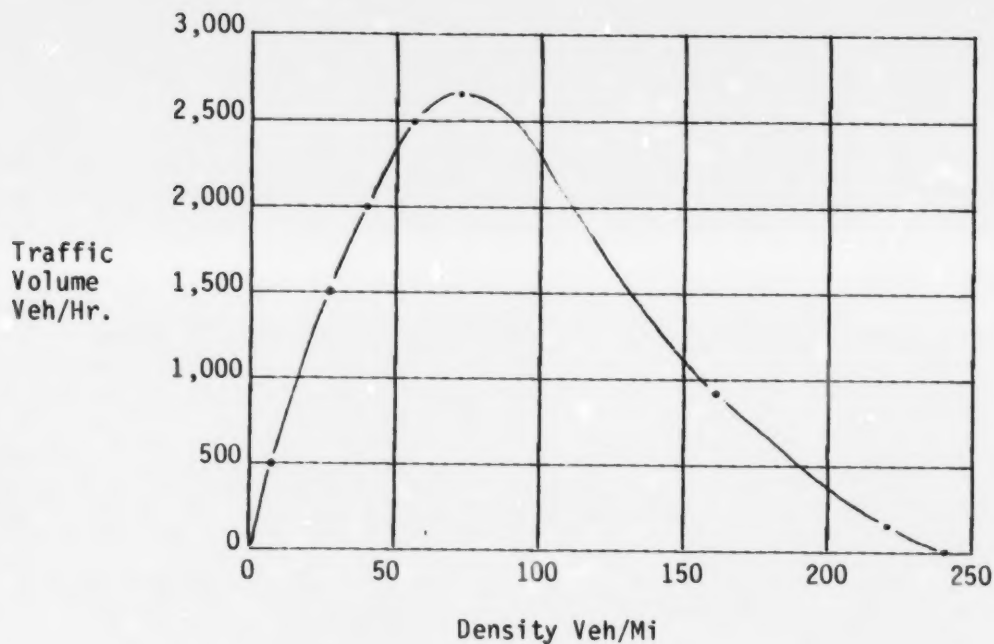


EXHIBIT A-3 VOLUME - DENSITY RELATIONSHIP

Using this function, characteristics of traffic (i.e. density and average speed of traffic) were determined for various traffic flows or volumes.

thus for $Q = 2,000 \Rightarrow K = 38.5 \text{ vpm}$
 $V = 51.9 \text{ mph}$

where the function parameters are:

free flow speed (V_f) = 60 mph
 density at capacity (K_m) = 73 vph
 jam density (K_j)
 (density behind 1 lane closure) = 220 vpm
 (density behind 2 lane closure) = 240 vpm

Assumption #2 The first assumption represents the static element in modelling traffic movement. This second assumption is used to add the dynamic component required to simulate the effects of traffic blockage by an incident. The functional form shown in equation 3 relates the speed at which queues develop to the traffic conditions before and after an incident occurrence.

Waves propagate back into traffic at:

$$W_s = \frac{Q_2 - Q_1}{K_2 - K_1} \quad \dots 3$$

where W_s = the shock wave speed, mph

Q_2, Q_1 = traffic volumes around the blockage and during unobstructed flow, respectively

K_2, K_1 = densities of traffic corresponding to Q_2 and Q_1 respectively, determined from equation 2

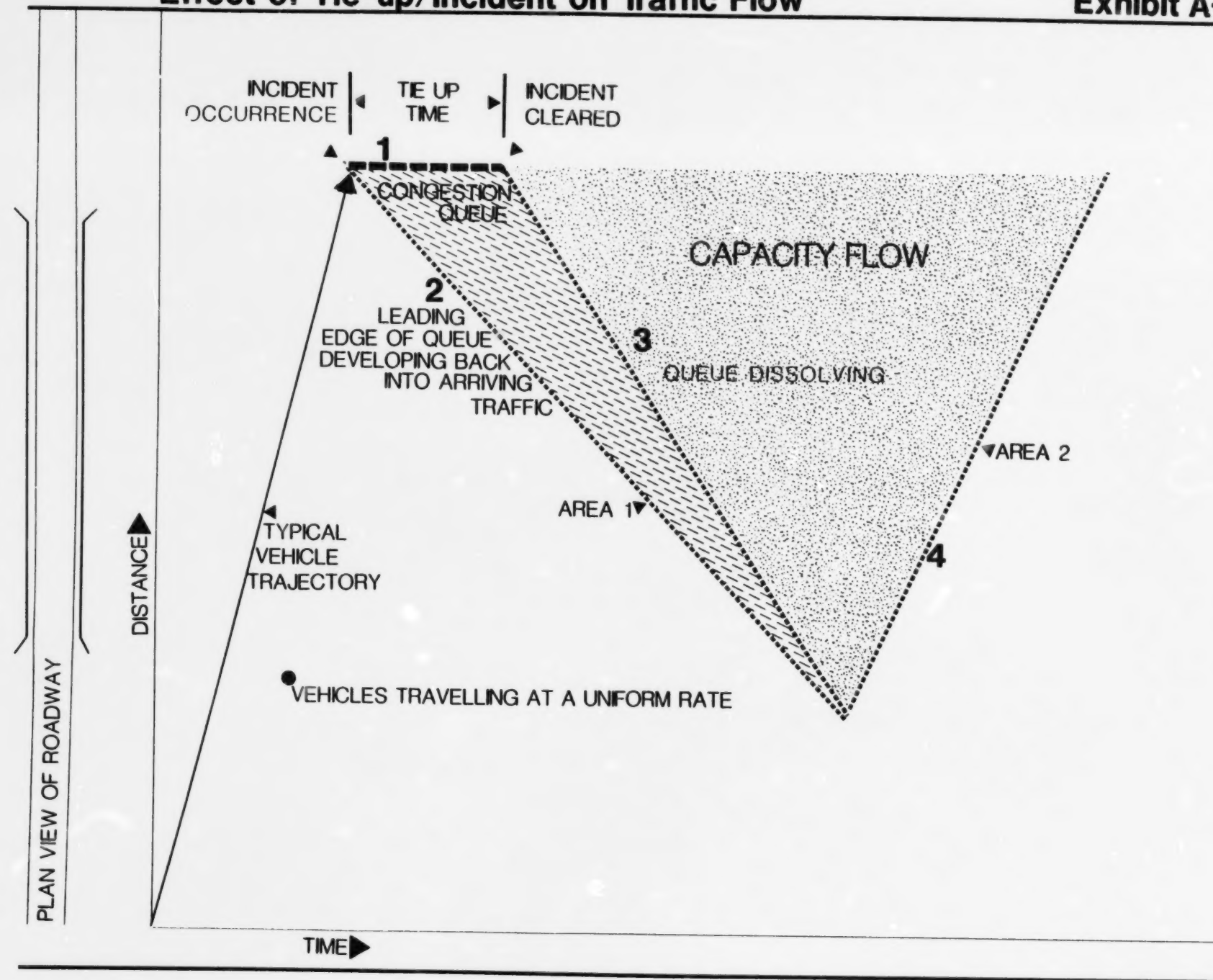
These two equations (equation 2 and 3) include the following assumptions:

- o uniform flow throughout queue development and dissipation
- o uniform traffic characteristics along upstream roadway for length of queue
- o motorists react in a specified manner during braking and acceleration, and are uniform in their actions

Using these calculation tools a space-time graph can be prepared similar to that shown in Exhibit A-4.

Effect of Tie-up/Incident on Traffic Flow

Exhibit A-4



Calculation of Delay

Referring to Exhibit A-4 the total delay was calculated as the sum of the following two areas:

AREA 1: bounded by lines indicated as 1 , 2 and 3

- where o line number 1 is the time during which incident affects roadway traffic by impeding movement (e.g. full blockage in Exhibit 3, $kj = 240$)
- o line number 2 is the leading edge of the queue as it builds back into traffic (this rate being determined by the procedure already outlined)
- o line number 3 represents the leading edge of the queue dissipation (i.e. the rate at which the vehicles depart from a standing queue and commence moving at a flow rate equal to the roadway capacity).

AREA 2: bounded by lines indicated as 3 , 4 and a projection of line 1 to its intersection with line 4 .

- o line number 4 represents the trailing edge of traffic moving at the roadway's capacity.

NOTE: the delay due to traffic moving at the slower speeds associated with capacity beyond/upstream from the incident site has been omitted due to the probability that any upstream interchange would act to reduce freeway congestion

A series of steps used in estimating the total delay are described below:

STEP 1:

In order to calculate the vehicle hours of delay the number of vehicles involved must be determined. Thus:

$$\text{the number of vehicles} = \text{flow rate (vph)} \cdot \text{time (h)} \\ \text{(past a point)}$$

Delay was calculated differently depending on the type of queue.

STEP 2:Full Closure

- o during Area 1, jam density delay, queue speed = 0

$$\text{delay/veh} = \text{avg time of queue}$$

$$= 1/2 \text{ incident tie-up time}$$
- o during Area 2, capacity density delay, the queue speed = 36 mph

max upstream queue dist = distance (mi) to back of queue
 (point Z in figure 2)

$$\text{avg delay} = \frac{1}{2} \left[\frac{\text{max upstream Q dist.}}{\text{capacity flow speed}} - \frac{\text{max. upstream Q dist.}}{\text{undisturbed flow speed}} \right]$$

$$\text{delay/veh} = \text{avg. delay}$$

Partial Closure

- o jam density (occurs for up to 1 minute immediately after incident) queue speed = 0.6 mph
- o partial closure delay = assumed capacity of one lane reduced to 900 vph - at 6 mph delay calculated using similar approach to that for 'capacity density delay'
- o capacity density delay - as outlined in full closure delay calculations

STEP 3:

Then using this delay estimation procedure, the total vehicle hours of delay for incidents occurring with varying undisturbed traffic volumes each 30 minutes in duration, were calculated

The capacity assumed for QEW was 2,650 vph

STEP 4:

The final stage in developing the delay per incident is to add the variable of incident duration:

from 5 to 60 min.

thus the calculations for delay were repeated for selected traffic volumes to determine the relationship of:

- o total vehicle hours delay
- o total number of vehicles affected
- o average delay

with incident duration

thus Exhibits A-1 and A-2 represent the product of the analytical process and values from these tables were used directly in estimating the total delay and therefore the benefits associated with the Freeway Traffic Management System.

STEP 5:

In order to expand these results to Stage 2 the following assumption was applied.

- o that the delay/partial closure is a function of the percentage residual capacity of the roadway. The function being defined as is shown in Exhibit A-5.

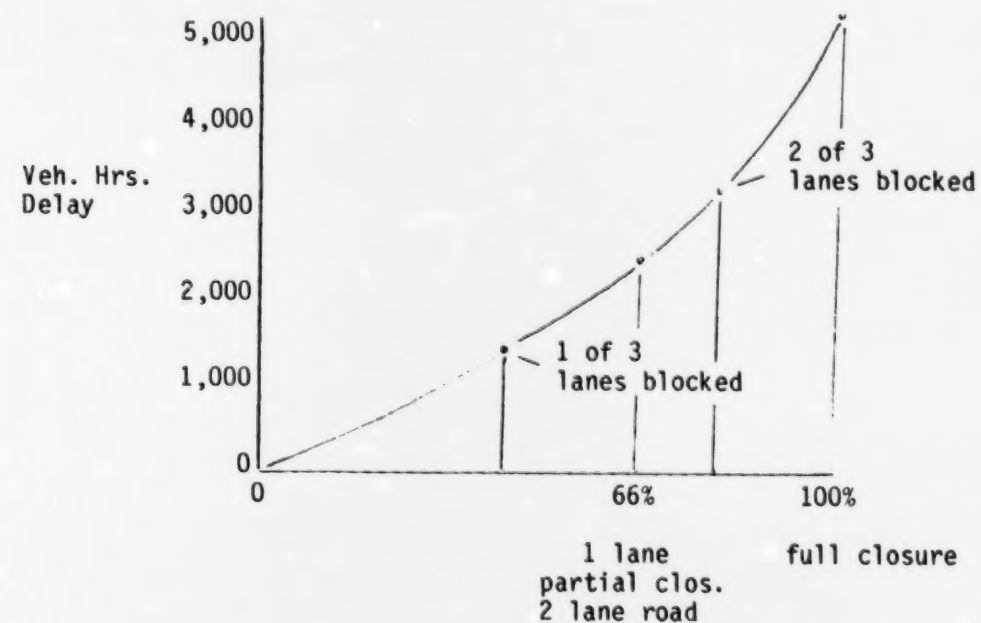


EXHIBIT A-5: DELAY - LANE CLOSURE RELATIONSHIP

- o the equation shown is:

$$4,808 \cdot (\text{resid. cap})^2 + 614 \cdot (\text{resid cap}) = \text{veh hrs delay}$$

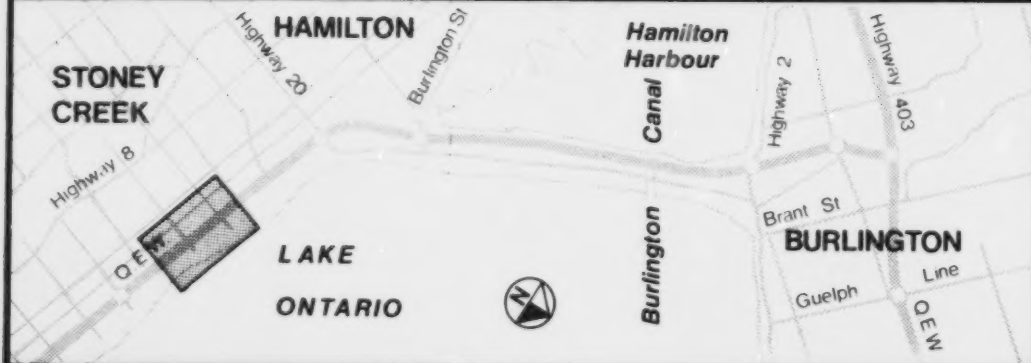
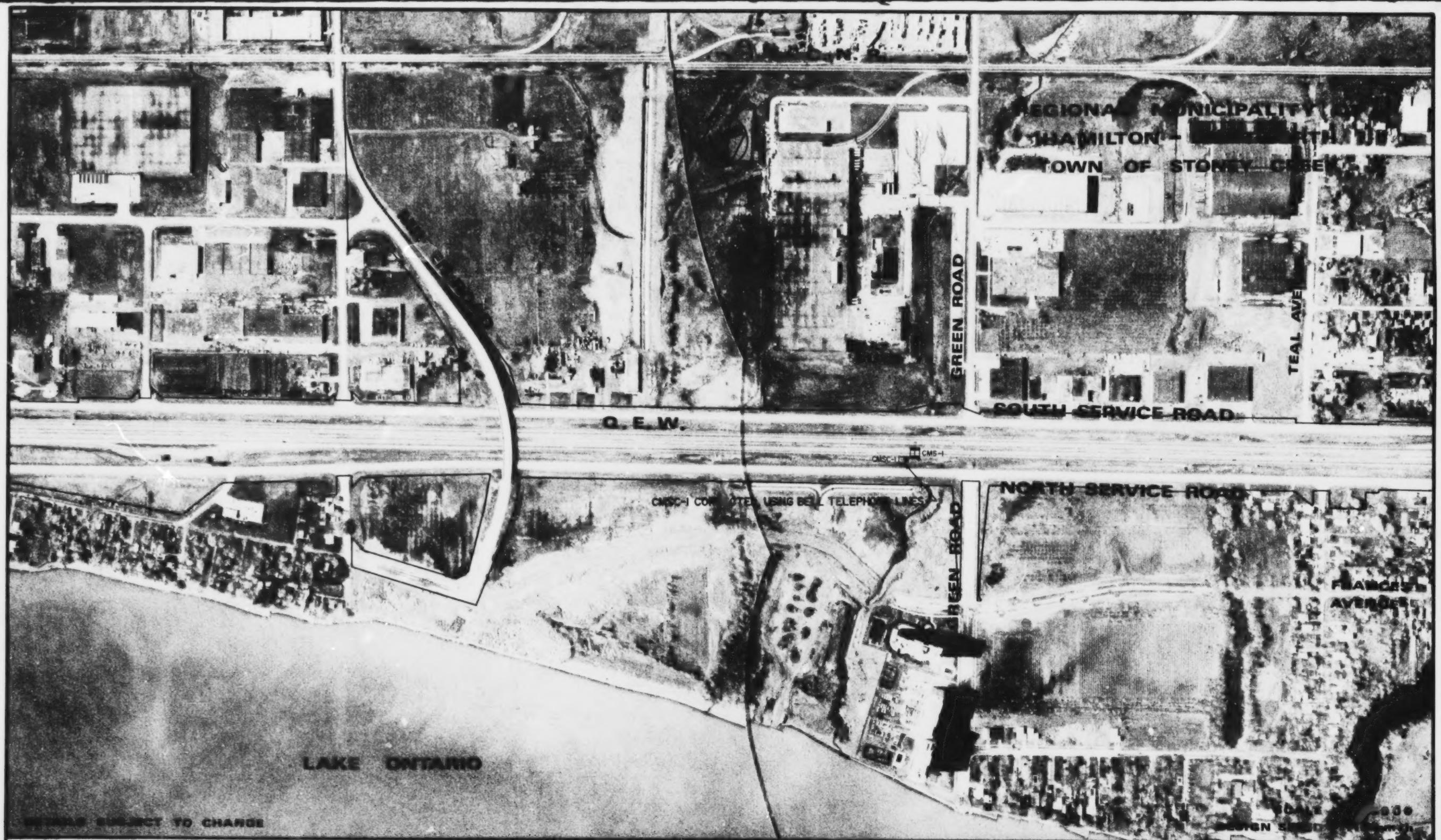
this was then adjusted for the higher capacity of the roadway (will be doubled - 5,350 vph was used)

APPENDIX B

BURLINGTON SKYWAY Freeway Traffic Management System

1:5000 PLATES

STAGE 1



BURLINGTON SKYWAY **FREEWAY TRAFFIC** **MANAGEMENT SYSTEM** **QUEEN ELIZABETH WAY**

1

STAGE 1



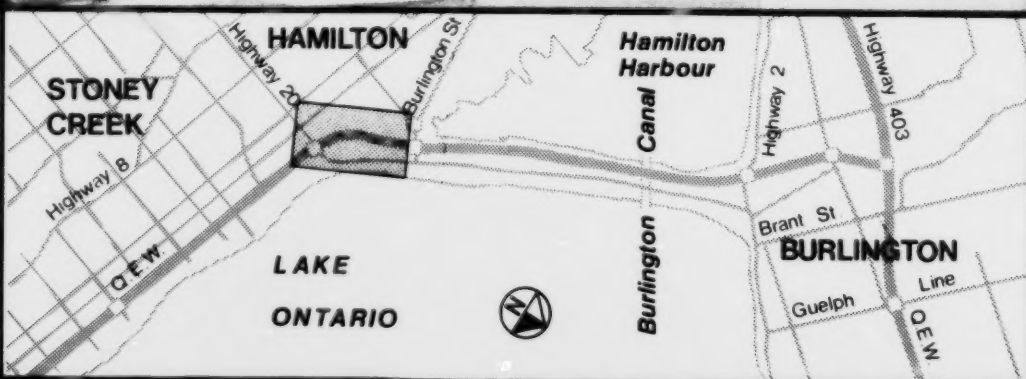
2

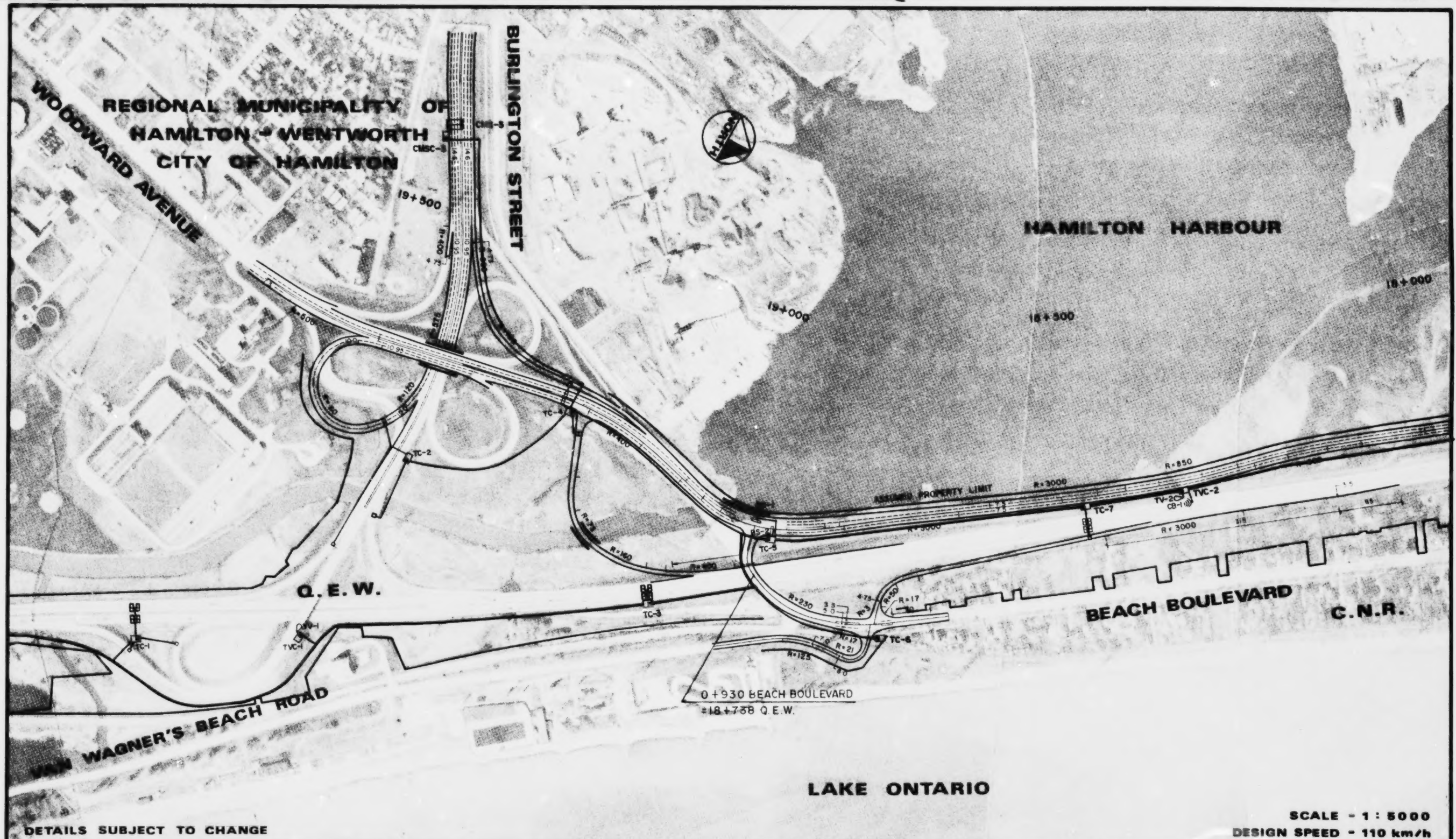
STAGE 1

BURLINGTON SKYWAY

FREEWAY TRAFFIC MANAGEMENT SYSTEM

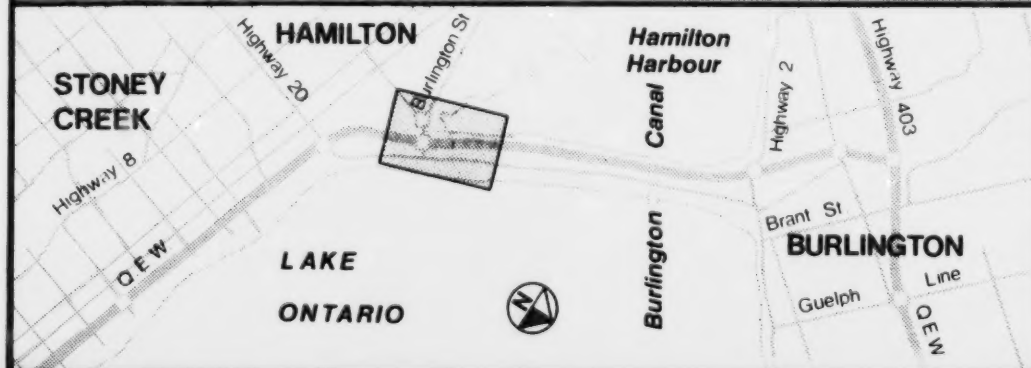
QUEEN ELIZABETH WAY





DETAILS SUBJECT TO CHANGE

SCALE - 1 : 5000
DESIGN SPEED - 110 km/h



BURLINGTON SKYWAY **FREEWAY TRAFFIC** **MANAGEMENT SYSTEM** **QUEEN ELIZABETH WAY**

3

STAGE 1

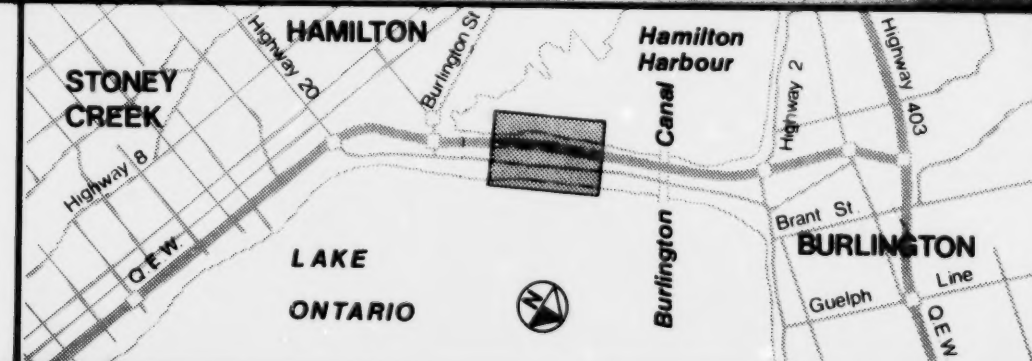
REGIONAL MUNICIPALITY OF
HAMILTON - WEST
CITY OF



4

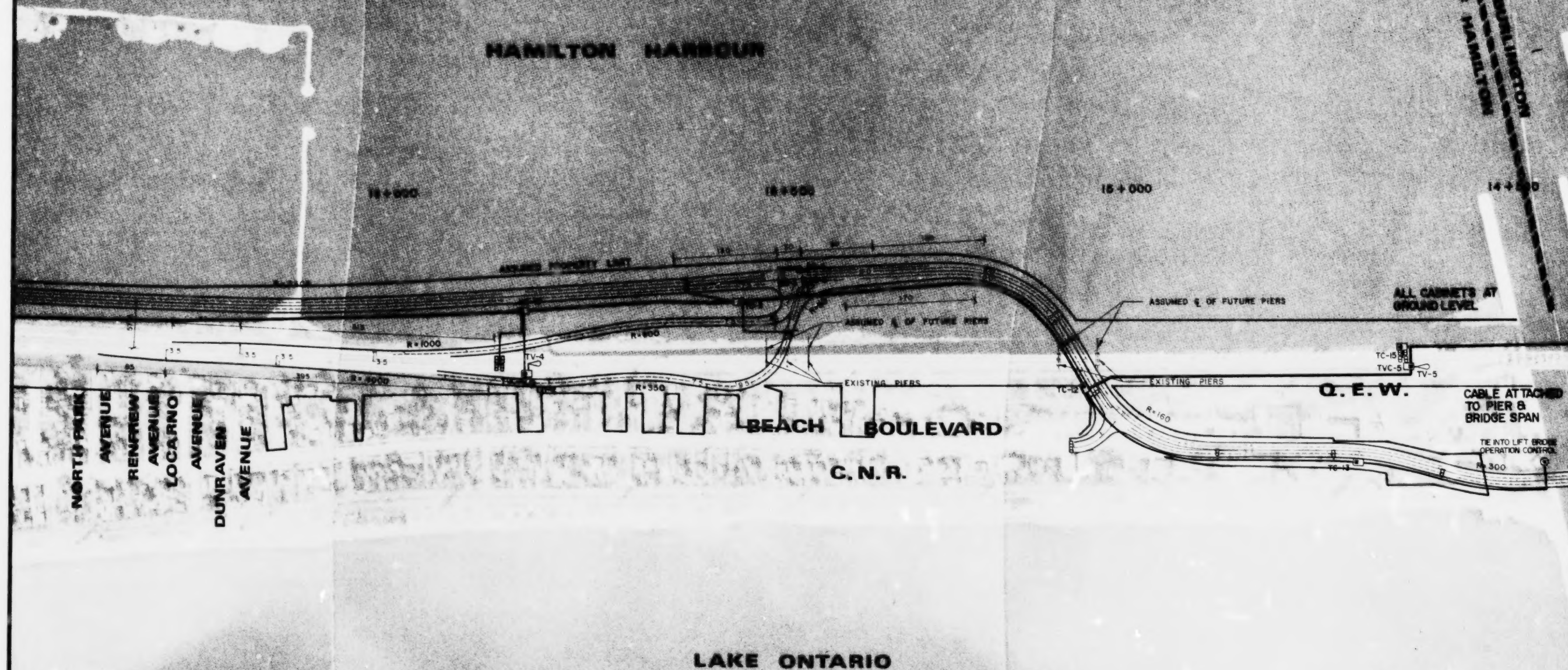
STAGE 1

BURLINGTON SKYWAY
FREEWAY TRAFFIC
MANAGEMENT SYSTEM
QUEEN ELIZABETH WAY



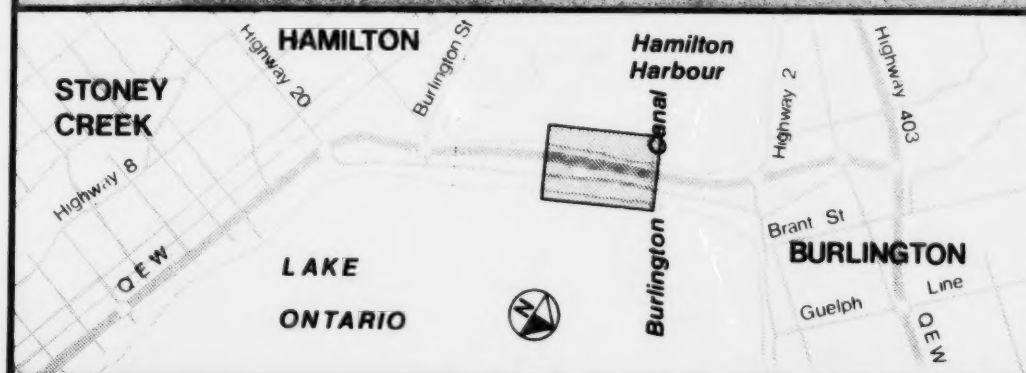
HAMILTON HARBOR

CITY OF BURLINGTON
CITY OF HAMILTON



DETAILS SUBJECT TO CHANGE

SCALE - 1 : 5000
DESIGN SPEED - 110 km/h



BURLINGTON SKYWAY

FREEWAY TRAFFIC

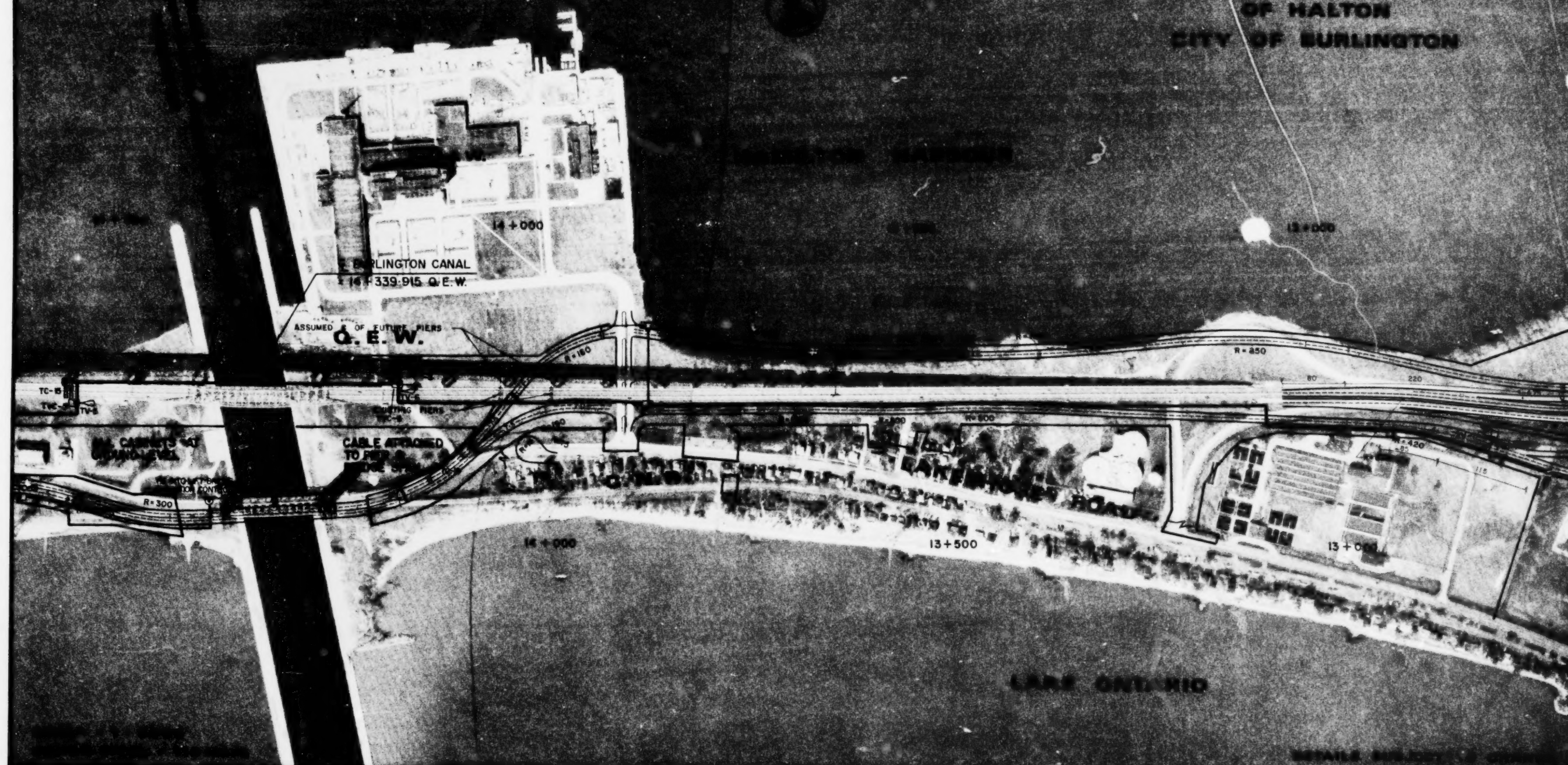
MANAGEMENT SYSTEM

QUEEN ELIZABETH WAY

5

STAGE 1

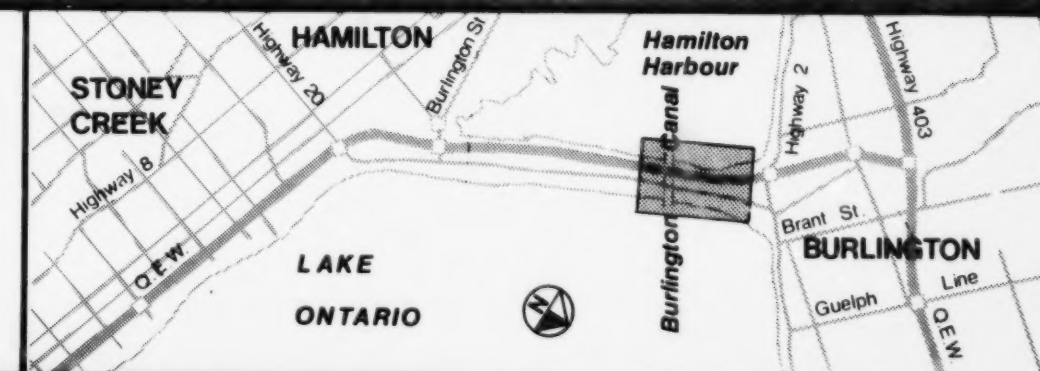
REGIONAL MUNICIPALITY
OF HALTON
CITY OF BURLINGTON

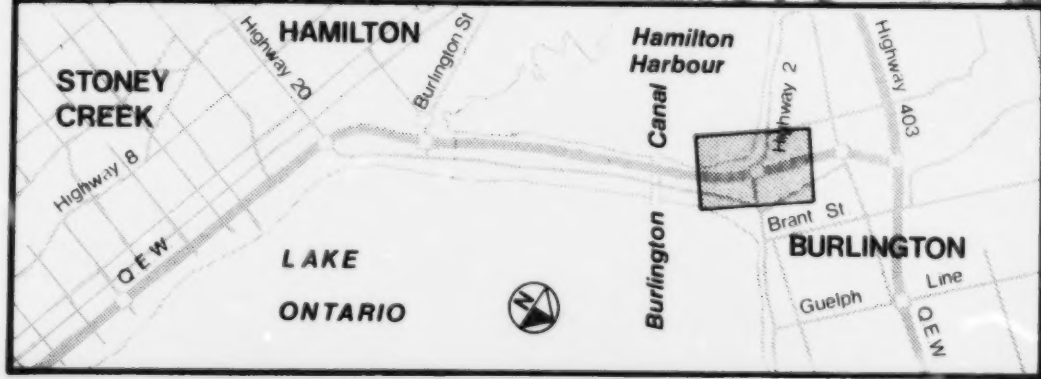


6

STAGE 1

**BURLINGTON SKYWAY
FREEWAY TRAFFIC
MANAGEMENT SYSTEM
QUEEN ELIZABETH WAY**





BURLINGTON SKYWAY

FREEWAY TRAFFIC MANAGEMENT SYSTEM

QUEEN ELIZABETH WAY

7

STAGE 1

8

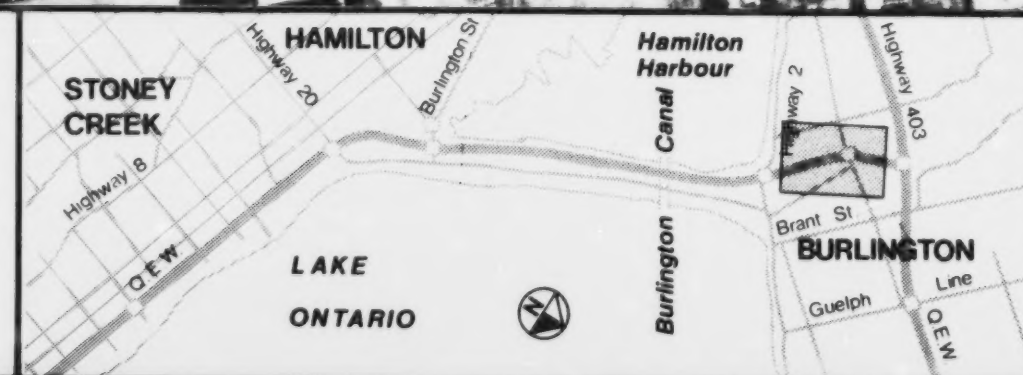
STAGE 1

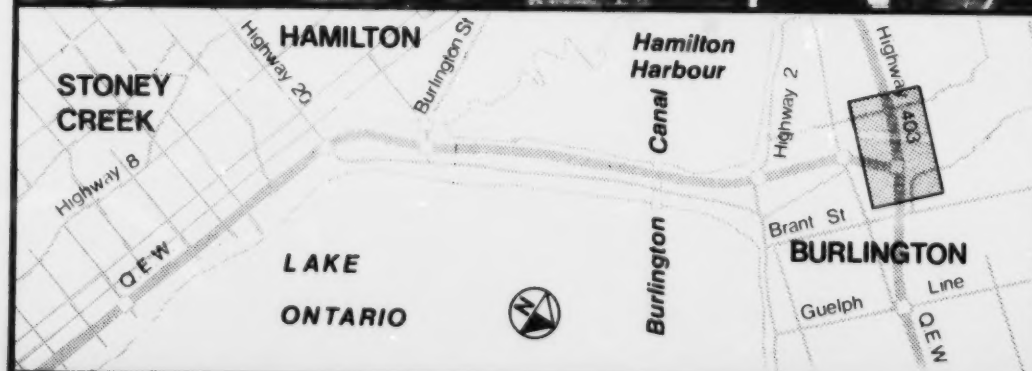
BURLINGTON SKYWAY

FREEWAY TRAFFIC

MANAGEMENT SYSTEM

QUEEN ELIZABETH WAY

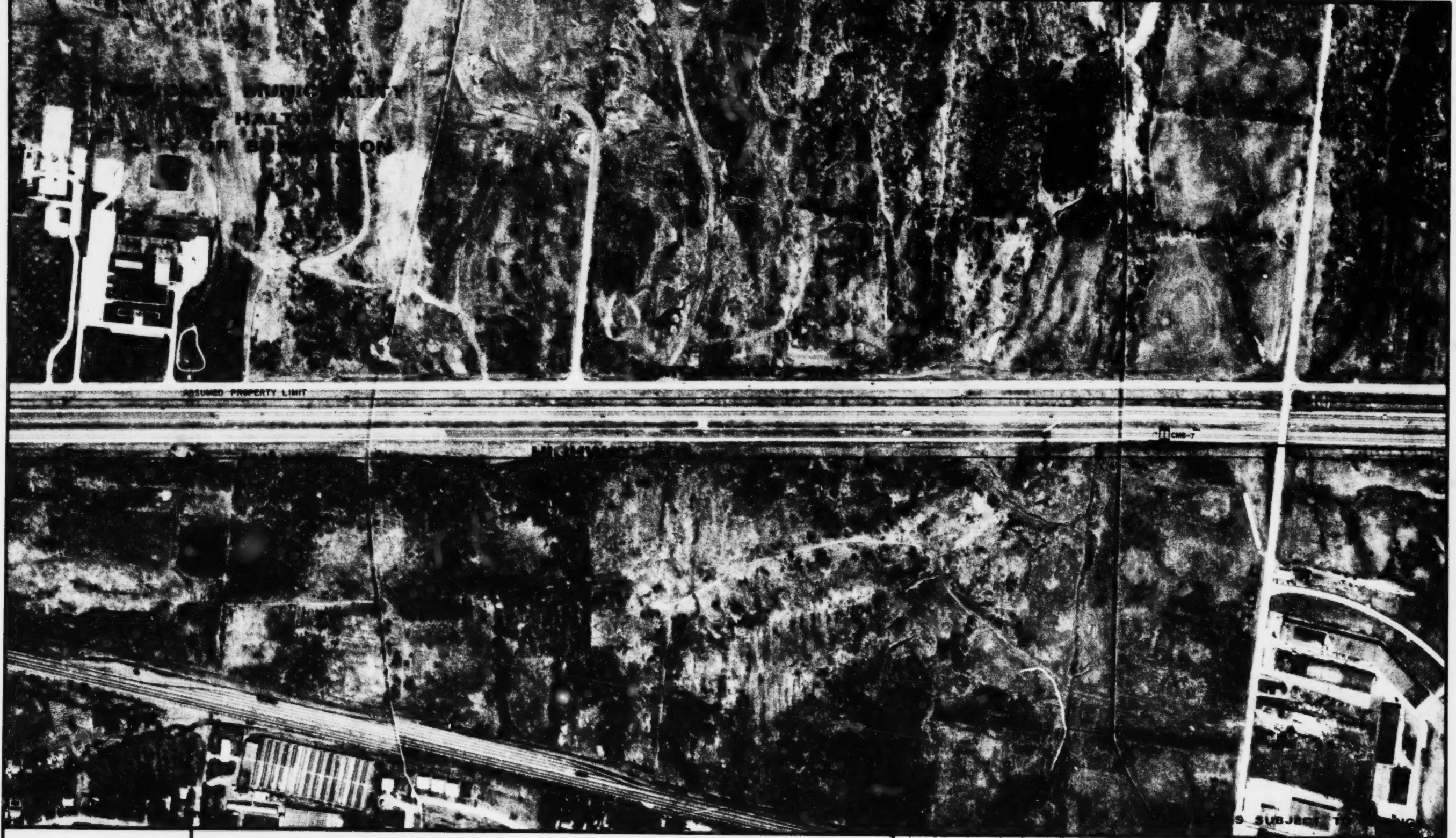




BURLINGTON SKYWAY **FREEWAY TRAFFIC** **MANAGEMENT SYSTEM** **QUEEN ELIZABETH WAY**

9

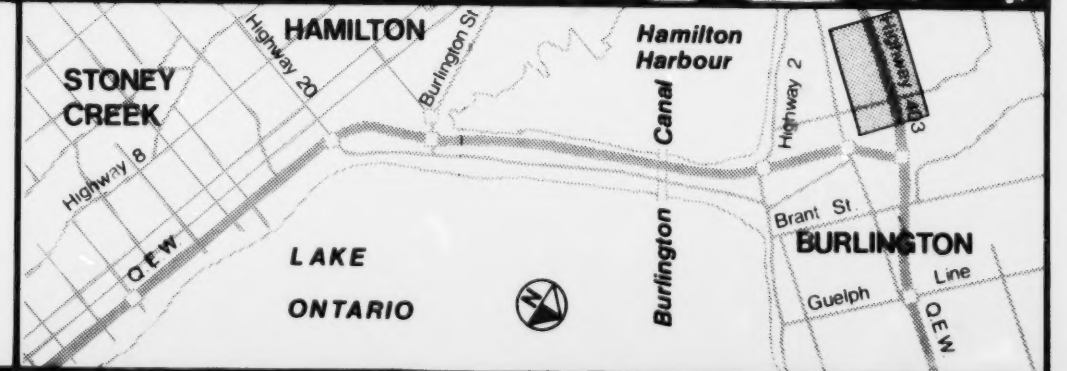
STAGE 1

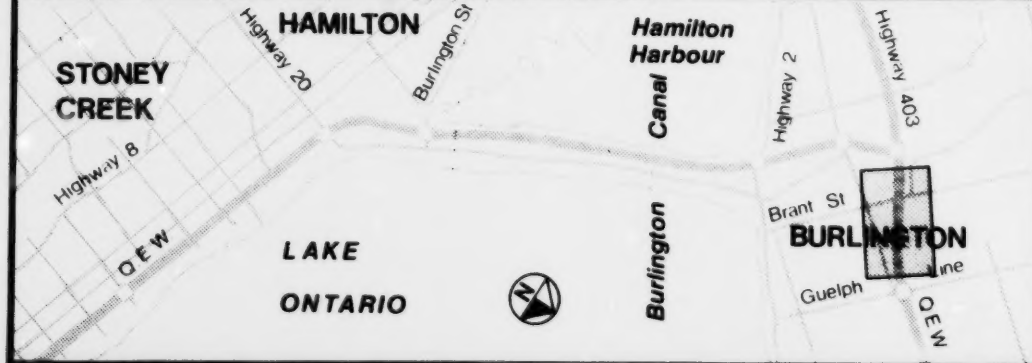


10

STAGE 1

BURLINGTON SKYWAY
FREEWAY TRAFFIC
MANAGEMENT SYSTEM
QUEEN ELIZABETH WAY





BURLINGTON SKYWAY
FREEWAY TRAFFIC
MANAGEMENT SYSTEM
QUEEN ELIZABETH WAY

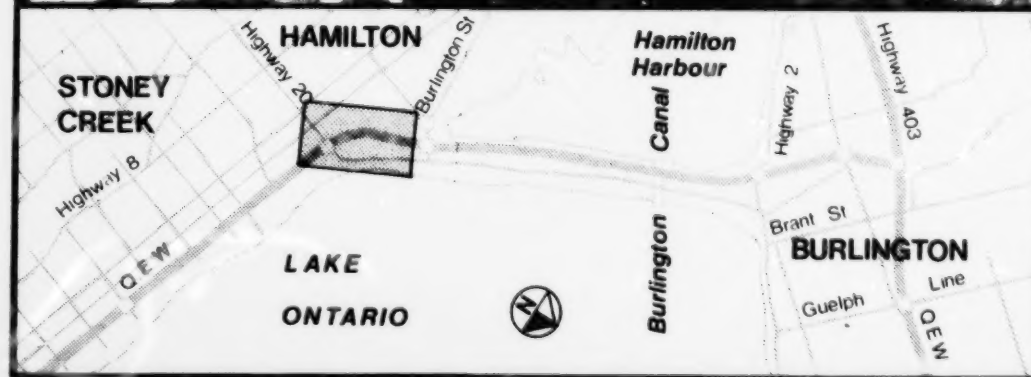
11
STAGE 1

APPENDIX B

BURLINGTON SKYWAY Freeway Traffic Management System

1:5000 PLATES

STAGE 2



BURLINGTON SKYWAY

FREEWAY TRAFFIC MANAGEMENT SYSTEM

QUEEN ELIZABETH WAY

12

STAGE 2

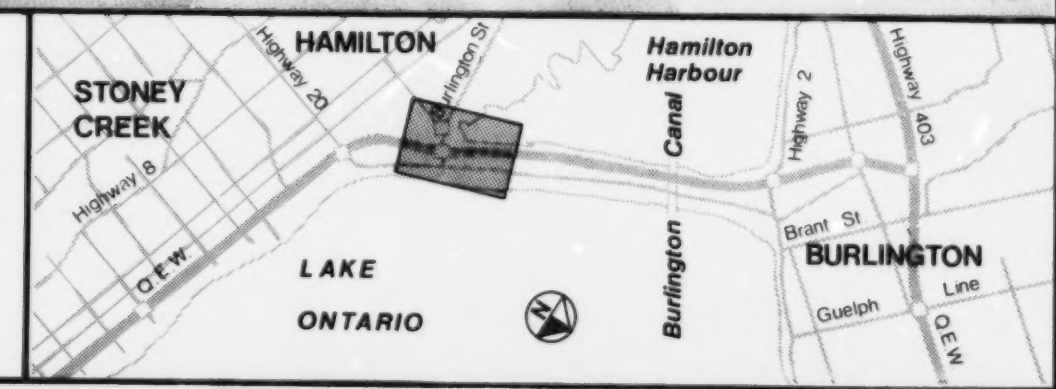


DETAILS SUBJECT TO CHANGE

13

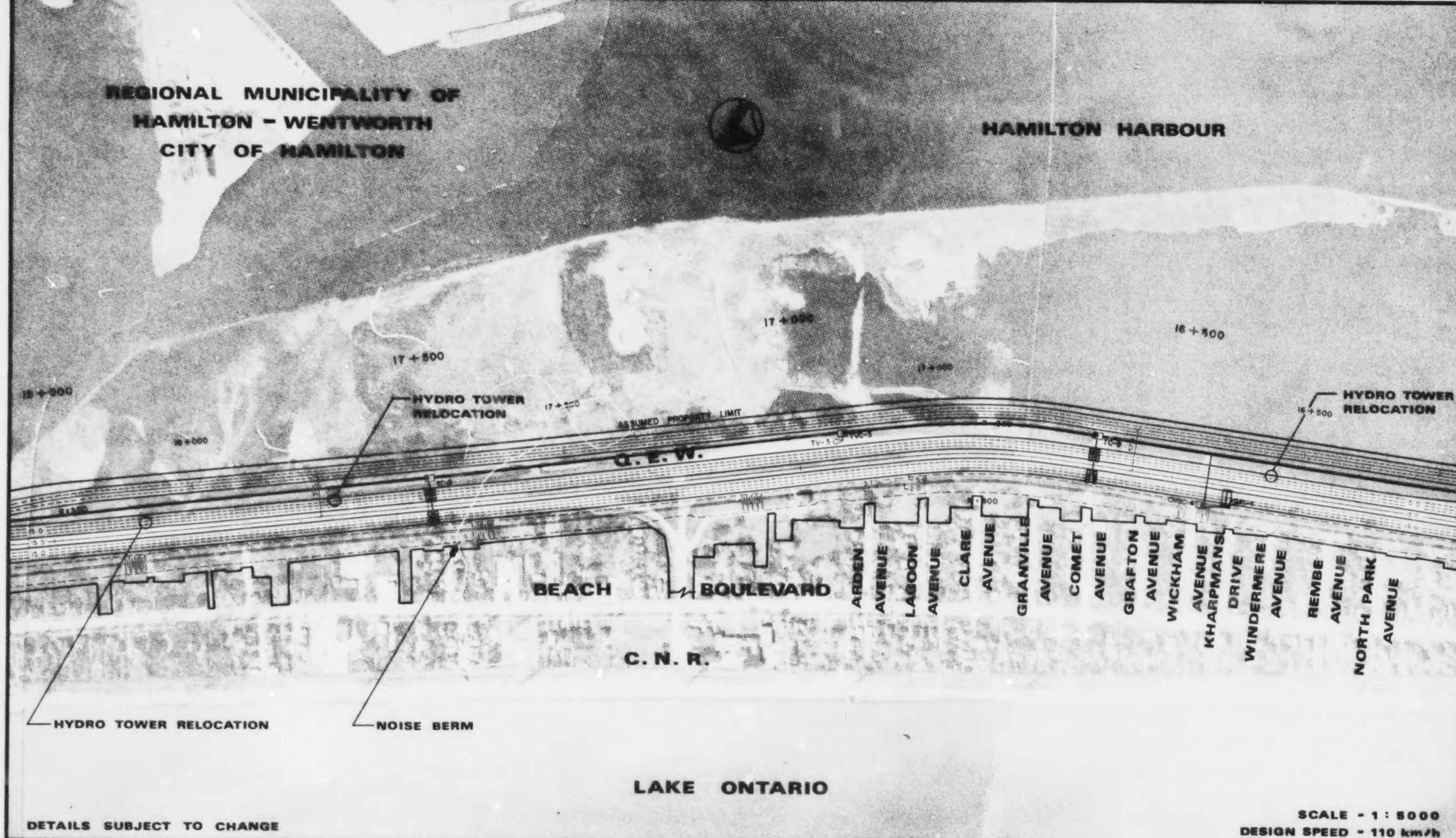
STAGE 2

**BURLINGTON SKYWAY
FREEWAY TRAFFIC
MANAGEMENT SYSTEM
QUEEN ELIZABETH WAY**



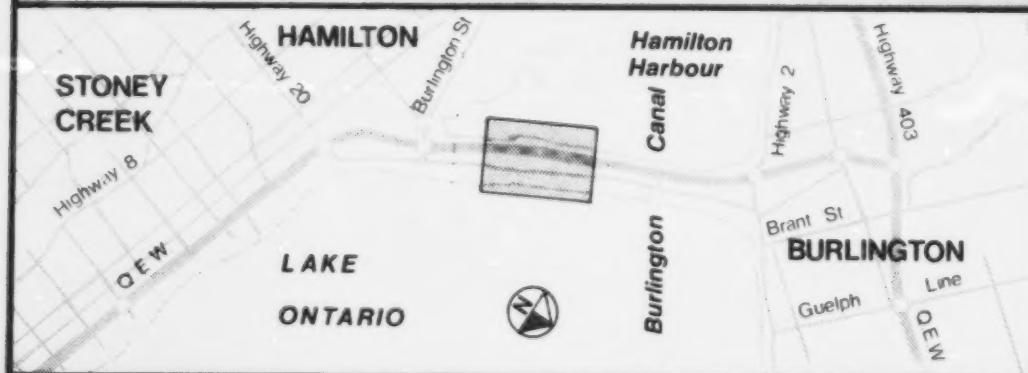
REGIONAL MUNICIPALITY OF
HAMILTON - WENTWORTH
CITY OF HAMILTON

HAMILTON HARBOUR



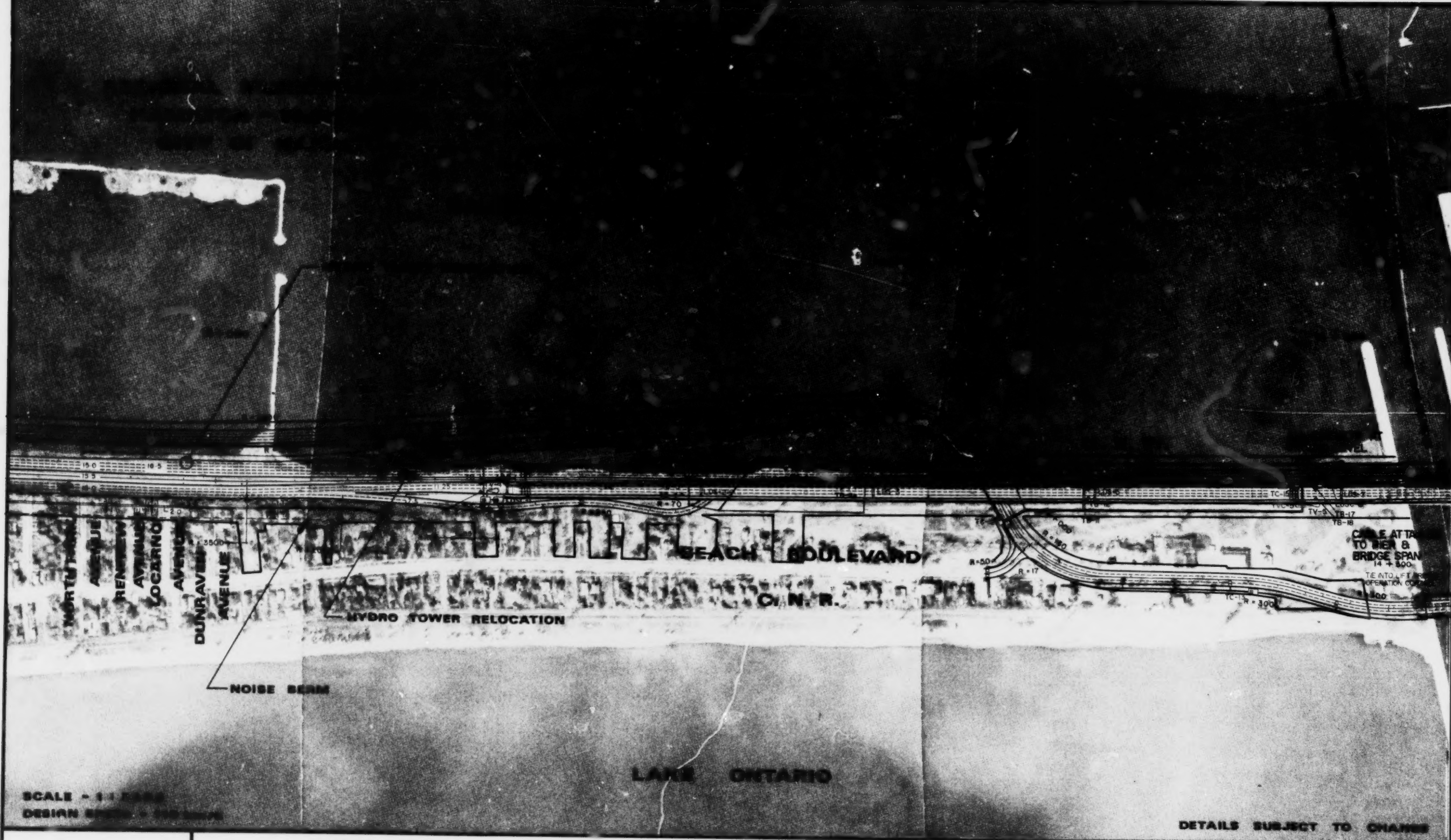
DETAILS SUBJECT TO CHANGE

SCALE - 1 : 5000
DESIGN SPEED - 110 km/h



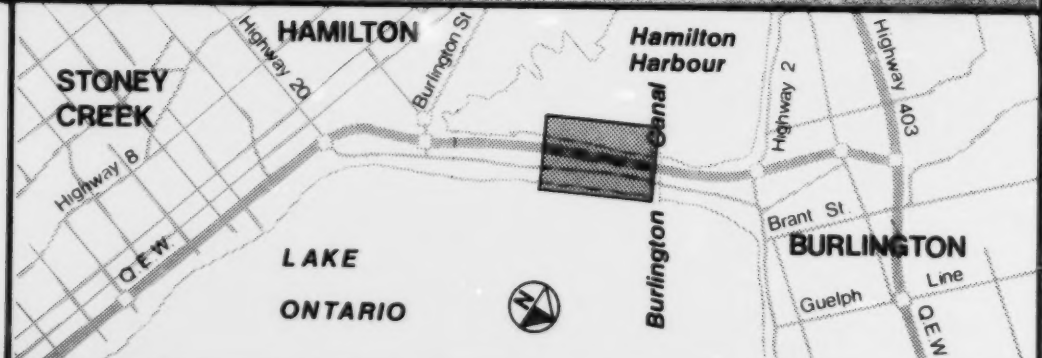
BURLINGTON SKYWAY
FREEWAY TRAFFIC
MANAGEMENT SYSTEM
QUEEN ELIZABETH WAY

14
STAGE 2

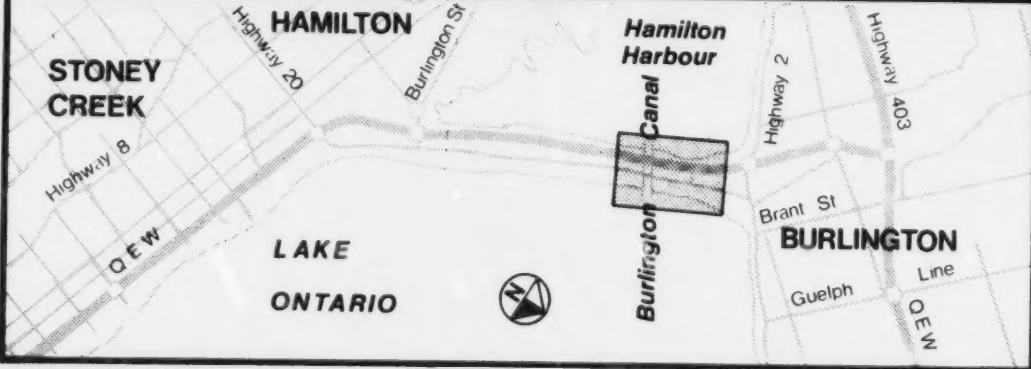
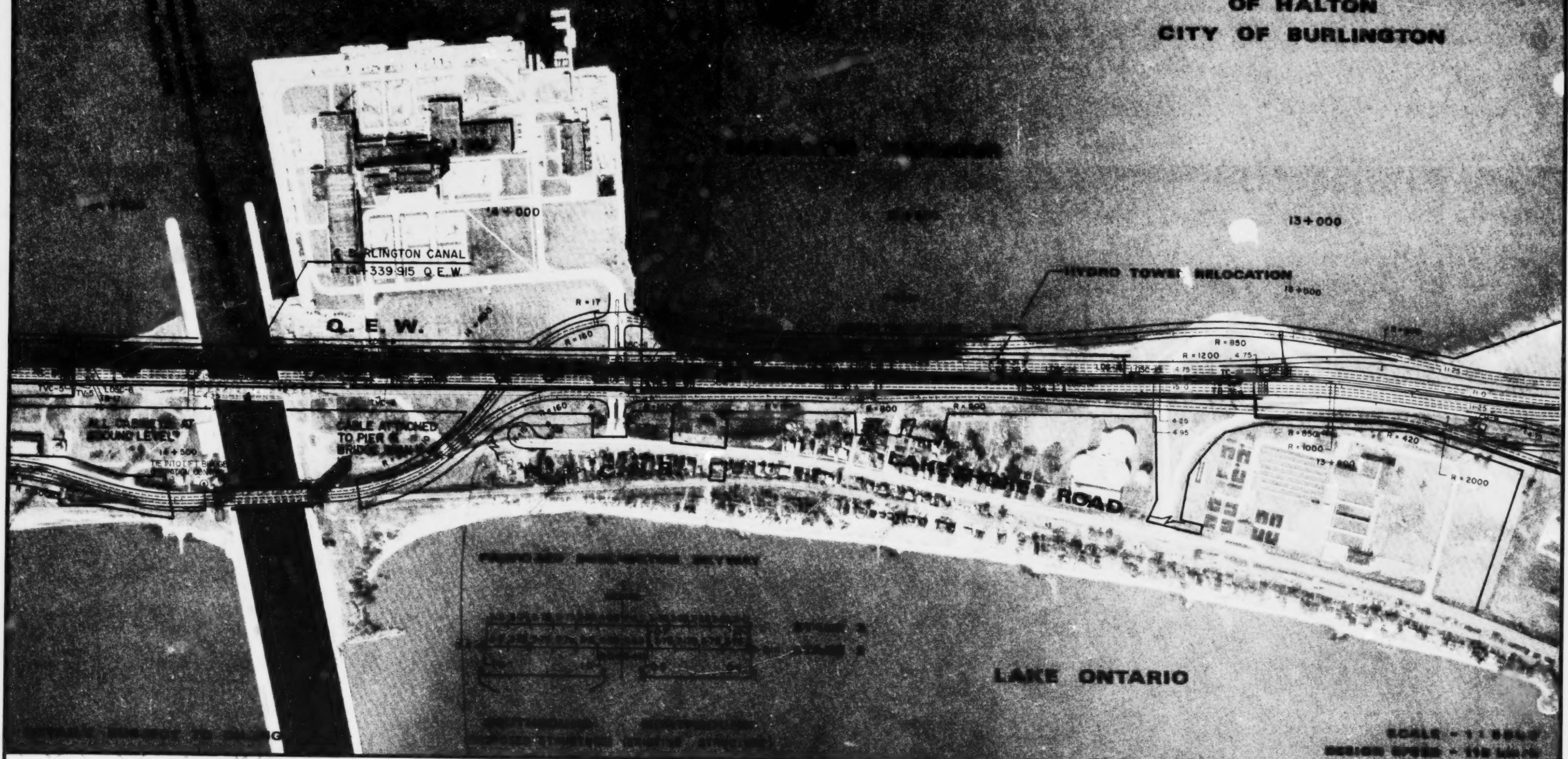


15
STAGE 2

**BURLINGTON SKYWAY
FREEWAY TRAFFIC
MANAGEMENT SYSTEM
QUEEN ELIZABETH WAY**

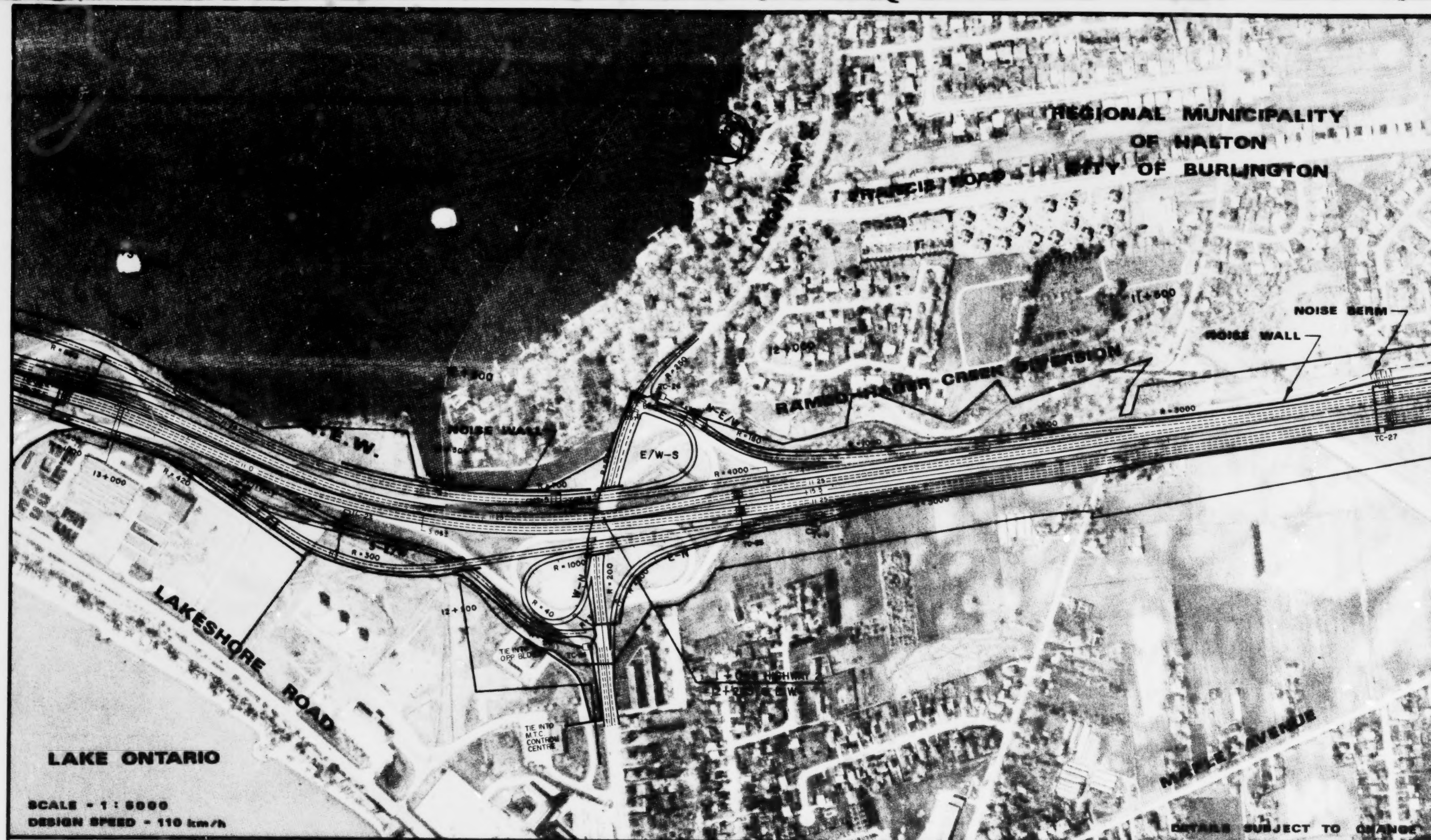


REGIONAL MUNICIPALITY
OF HALTON
CITY OF BURLINGTON



BURLINGTON SKYWAY
FREEWAY TRAFFIC
MANAGEMENT SYSTEM
QUEEN ELIZABETH WAY

16
STAGE 2



17 STAGE 2	BURLINGTON SKYWAY FREEWAY TRAFFIC MANAGEMENT SYSTEM QUEEN ELIZABETH WAY	This inset map shows the project's location within the Greater Toronto Area. It includes labels for STONEY CREEK, HAMILTON, Hamilton Harbour, Burlington, Brant St, Guelph, Line, Q.E.W., Highway 8, Highway 20, Highway 403, and Highway 2. A north arrow is also present.
--	---	--

APPENDIX C

BURLINGTON SKYWAY Freeway Traffic Management System

SUMMARY OF CORRESPONDENCE

memorandum



To: Mr. H.F. Gilbert,
Deputy Minister,
East Building.

Date: 1982 06 22.

Re: Burlington Skyway Freeway Traffic Management System
(F.T.M.S.) Preliminary Design Study - W.P. 85-81-00

A presentation on the Preliminary Design of a Proposed Freeway Traffic Management System (F.T.M.S.) for the Burlington Skyway (Q.E.W.) was made to the Management Review Committee on 82 06 09. The proposal was previously reviewed and approved by the project team, Central Region and technical representatives from the local municipal governments and the O.P.P. Fred Allen and I have subsequently met to review the proposal further and we now recommend that the M.T.C. should proceed with the implementation of the proposed F.T.M.S.

The objectives of the F.T.M.S. are to provide for incident management to quickly and effectively respond to incidents (accidents, breakdowns, bridge maintenance, weather, etc.) in the corridor and to encourage commuter traffic to use the new arterial road.

There are a number of elements which would be required for the proposed system:

1. Control room - to provide centralized control
2. Computer and software - for data gathering, monitoring, operations and response capabilities
3. Communications system - network required to interconnect the elements of the system
4. Detectors - to provide automatic incident detection
5. T.V. Cameras - to accurately determine the type and location of incidents in order to take the most appropriate response
6. Changeable Message Signs - to provide the ability to institute motorist response plans to incidents.

In addition to the above there are a number of elements which could be considered enhancements to the system.

Mr. H.F. Gilbert

- 2 -

1982 Oct 22.

The cost for this system to be in place when Stage 1 of the roadwork construction in the corridor is complete, is estimated to be \$3,439,000 (including 20% for contingencies and engineering).

Some elements of the system such as C.B. radio, Highway Advisory Radio and additional traffic detectors could be considered enhancements to the system and could be deleted from the system for a cost saving of \$126,000 (including 20% for contingencies and engineering). These elements could be added at a later date if it is desirable to omit them initially.

After Stage 2 road construction is completed (new Skyway built and both Skyways operational), lane designation signs on the Skyways would be required to institute lane closures and to designate truck lanes during high wind conditions. The cost of the lane designation signs and some additional detectors to provide automatic incident detection on the new Skyway is approximately \$432,000 (including 20% for contingencies and engineering). The system could be further enhanced at that time by the addition of call boxes on the Skyway, at an approximate cost of \$119,000 (including 20% for contingencies and engineering).

It is important to note that the system is cost-beneficial over any period of operation longer than 19 months. Most of the benefits will be realized prior to the Twin Skyways becoming operational. Assuming that the F.T.M.S. could be operational for 4 years prior to the opening of both Skyways, the benefit/cost ratio would be 1.93:1 (4 year write-off period).

After the Twin Skyways are operational and based on the initial (Stage 1) costs having been written off, the Stage 2 benefit/cost ratio is still favourable at 2.47:1, considering a more normal write-off period of 10 years.

The potential benefits of the system were conservatively calculated in terms of person hour savings, commercial vehicle savings and fuel savings. A number of additional benefits were identified but not quantified, such as: reduced potential for accidents, better traffic data processing and collection, ability to institute diversions quickly and with less manpower (than presently used), reduced demand on the Skyway (beneficial until Skyway is twinned) and improved safety for maintenance operations.

.....cont'd 3

The total cost for the F.T.M.S. as proposed, is \$3,990,000, which is small in comparison to the total amount of money being expended for roadwork in the corridor. The total cost for the road construction (both Stage 1 and 2) is presently estimated at approximately \$100,000,000. The additional cost of 4% for the F.T.M.S. could be considered as protecting our investment in the corridor, by making the new road operate more efficiently.

It is proposed that the F.T.M.S. would be staged to be operational as the Stage 1 road contracts are completed. Based on current schedules, this means that a partial system could be in place by 1984 with partial benefits being realized. The complete system is expected to be in operation by 1985 when the Stage 1 road construction is expected to be fully completed.

Based on the current schedules, it is also quite likely that this system could be operational before the F.T.M.S. which is proposed for the Highway 401 Toronto Bypass. The operational experience which would be gained by having the Burlington Skyway F.T.M.S. implemented according to the present schedule, would be useful for the Highway 401 application.

In summary, I agree with the proposal as presented and I recommend its approval in order to proceed with the implementation of this project. Upon receipt of your approval, we intend to proceed with:

- presentations to the municipal councils, O.P.P. senior management and the public;
- renovations to the District 4 Office to accommodate the control centre;
- the purchase of a computer and associated equipment;
- the software development;
- the detail design and contract preparation of the field elements.

In order to be partially operational by 1984, it will be necessary to proceed with these steps immediately.

.....cont'd 4

Mr. H.F. Gilbert

- 4 -

1982 Oct 22.

If you should feel that it is desirable, a presentation of the proposal could be made to the Minister and yourself at your convenience.

Original Signed
L.R. EADIE

L.R. Eadie,
Assistant Deputy Minister,
Provincial Highways.

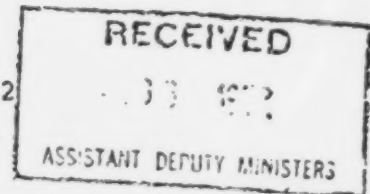
LRE/ERE/sls

c.c. F.G. Allen
T.G. Smith
A.G. Stermac
M.D. Harmelink

To: Mr. L.R. Eadie
Mr. J.F. Cederberg

Date: 82 08 05

Re: MANAGEMENT MEETING, JULY 26, 1982
Minute No. 82-25



For your information.

2. Burlington Skyway Freeway Traffic Management System - Preliminary Design Study

The purpose of this presentation was to seek approval of the preliminary design recommendations for the QEW/Burlington Skyway Corridor Freeway Traffic Management System.

It was proposed that a Traffic Management System operate in the QEW Corridor from Highway 403 in the City of Burlington southerly to Burlington Street in Hamilton. This corridor is scheduled to undergo capacity improvements in two stages which will first involve arterial road widenings up to 1985. In stage two, the Skyway Bridge will be twinned and operational by 1988.

The problem with respect to this corridor was identified as being congestion caused by 55,000 to 60,000 vehicles per day and a high number of incidents (over 1,000 per year) compounded by the absence of shoulders on the Skyway Bridge.

The objectives of the Traffic Management System will be to keep traffic flowing efficiently and safely, and protect road construction investment. Of primary importance will be the system's ability to encourage commuter use of the new arterial in order to achieve efficient use of all available capacity.

The proposed Freeway Management System will have three major elements dealing with incident management, computer information and bridge maintenance. Total cost requirements will be \$3,745,000 with a possible \$245,000 enhancement which together represent approximately 4 per cent of the capital road construction costs.

The system is designed to interface with the lift bridge operator, Ontario Provincial Police, the MTC dispatcher in District 4, Burlington traffic signal system and the media.

The submission also proposed a communication plan to the public, municipalities and private agencies. A number of necessary component developments (renovations to District 4 offices, purchase of computer and associated equipment, software development and detailed design of field electronic/electrical contact) were also identified.

The discussion noted that past discussions with Toronto radio stations, with respect to installing a highway advisory radio, was met with stiff opposition. It was suggested that this component be dropped from the Traffic Management System at this time and dealt with at a future Management SPC meeting, after further inquiries to the Hamilton radio stations.

A concern was expressed in regard to the costly extent which this project will entail. It was emphasized that the QEW/Burlington Corridor is a unique case and will require a minimum amount of expenditure in order to do anything effectively. Much of the highway investment will be lost if commuters cannot be successfully diverted to the improved arterial system. This project also represents an effort to reduce our dependence on capacity expansions.

The Traffic Management System is an integral part of overall improvement plans for this area. It was also noted that the Regional Municipality of Halton and the City of Burlington have conditioned their approval of this project, on acceptance of the Traffic Management System, through correspondence with the Ministry of Environment under The Environmental Assessment Act.

This item was also identified as an operational matter which would only require an information memo to the Minister, rather than a formal presentation.

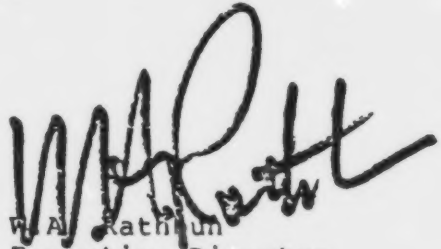
It was agreed that:

THE ASSISTANT DEPUTY MINISTER, PROVINCIAL HIGHWAYS,
WILL:

a) PROCEED WITH THE IMPLEMENTATION OF THE QEW/
BURLINGTON SKYWAY CORRIDOR FREEWAY TRAFFIC
MANAGEMENT SYSTEM, INCORPORATING BOTH THE BASIC
REQUIREMENTS AND SYSTEM ENHANCEMENTS, INCLUDING THE
FOLLOWING COMPONENTS:

- PRESENTATION TO MUNICIPALITIES, ONTARIO
PROVINCIAL POLICE, ONTARIO TRUCKING ASSOCIATION
AND THE PUBLIC;
- RENOVATIONS TO DISTRICT 4 OFFICES FOR CONTROL
CENTRE;

- PURCHASE OF COMPUTER AND ASSOCIATED EQUIPMENT;
 - SOFTWARE DEVELOPMENT; AND
 - DETAILED DESIGN OF FUEL ELECTRONIC/ELECTRICAL CONTRACT;
- b) AUTHORIZE THE APPROVAL OF THE NECESSARY FUNDS ESTIMATED AT \$4 MILLION;
- c) DEFER ANY ENHANCEMENT DEALING WITH A HIGHWAY ADVISORY RADIO AND IN CONJUNCTION WITH THE DIRECTOR, PUBLIC AND SAFETY INFORMATION BRANCH, REPORT BACK ON THIS SUGGESTION AFTER DISCUSSIONS WITH HAMILTON-AREA BROADCASTERS; AND
- d) PREPARE AN INFORMATION LETTER FROM THE DEPUTY MINISTER TO THE MINISTER, OUTLINING THE MAJOR ASPECTS OF THIS PROJECT.

A large, stylized handwritten signature in black ink, appearing to read 'W. A. Rathburn', is positioned above the printed name and title.

W. A. Rathburn
Executive Director
Strategic Policy Secretariat

memorandum

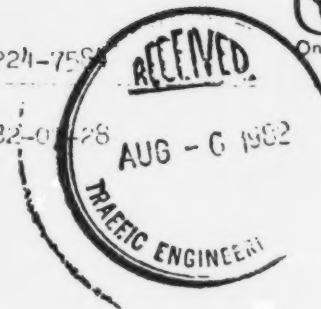
Planning & Design, Central Region

224-7588



To: The Honourable James W. Snow
Minister of Transportation and Communications
3rd Floor, Ferguson Block
77 Wellesley Street
Toronto, Ontario
M7A 1Z8

Date: 1982-07-28



Re: Halton's and Burlington's Joint Submission on the Environmental
Assessment
Queen Elizabeth Way
Burlington to Hamilton (Stage 2 and Stage 3)

The following clarification and comments are provided on the conditions of approval of the Q.E.W. E.A. that were recommended jointly by the Region of Halton and the City of Burlington. Particular reference is made to conditions b,d and f that you specifically queried:

Condition (a) That the Ministry of Transportation and Communications be requested to construct the Brant Street, Queen Elizabeth Way interchange as part of the Stage 2 improvements, Queen Elizabeth Way, Hwy. 20, Hamilton to Guelph Line, Burlington.

Comments - The Brant St./Q.E.W. interchange is shown in the E.A. as part of the ultimate Q.E.W. proposals, i.e. Stage 3. It is not an integral part of the Stage 2 commitments as it can not be constructed in advance of major (\$7,500,000) works at the Freeman interchange that are not required until Highway 403 is constructed.

The construction of the Brant St./Q.E.W. interchange is, however, being considered as the second contract in the Highway 403, Freeman to Hwy. 5 project. This full interchange would be in lieu of the committed slip-on ramp from Brant St. to the Q.E.W. eastbound. If Highway 403, Freeman to Hwy. 5, is constructed in the time frame currently proposed, 1985-1988, it will, I believe, satisfy the municipalities' concerns. Initial technical contact has been made with the City of Burlington staff on this issue but no commitments have been made.

Condition (b) That the Ministry of Transportation and Communications resolve the concerns of the City of Burlington as they relate to the diversion of the creeks due to the depressed grade of Highway 403 and the consequent need to make provision for the drainage in the recommended improvements to the Queen Elizabeth Way, Highway 20, Hamilton to Guelph Line, Burlington.

Comments - The depressed grade of Highway 403 between the Freeman Interchange and Highway 5 will intercept several watersheds. They are the watersheds of the East and West Rambo and Hager Creeks.

Several alternative drainage schemes have been considered ranging from maintaining the existing drainage patterns to diverting all intercepted flows along the Highway 403 right-of-way. One of the diversion schemes is favoured by Burlington, M.T.C. and the Halton Region Conservation Authority due to its anticipated overall cost savings and benefits. A detailed drainage study and a cost sharing agreement are still pending. We anticipate that the favoured drainage scheme will prove to be the best alternative and that an acceptable cost sharing agreement, will be reached. M.T.C.'s stage 1 improvements are therefore being designed to accommodate this scheme. Final agreement should be reached before contracts are called.

Condition (c) That the Ministry of Transportation and Communications consult with the City of Burlington regarding the provision of noise barriers and landscaping within the Skyway Corridor and the movements of heavy vehicles (designated haul routes) associated with the construction of the Stage 1, 2 and 3 improvements, with particular reference to the reduction of noise levels on the present and proposed Skyway Bridge.

Comments - This would be a routine part of design and is being already carried out for the Stage 1 improvements. An additional meeting may be required to explain our planning proposals. This will be arranged.

Condition (d) That the Ministry of Transportation and Communications be advised that Burlington and Halton Region support the preparation of a "Design and Construction Report" and further, that they consult with the City of Burlington, Regional Municipality of Halton, Halton Region Conservation Authority and other appropriate agencies in the preparation of this document.

Clarification In seeking approval for the Stage 2 improvements, MTC made the commitment to supply "design and construction" reports for information and monitoring purposes. These reports will be submitted immediately prior to construction and will be prepared in accordance with the outline for Chapter 5 of M.T.C.'s Class Environmental Assessments. A description of the selected design, specific construction requirements, potential environmental condition changes, and mitigating measures would be contained in this report.

We are submitting similar documents for the Stage 1 improvement and have no reservations about the requested consultation.

Condition (e) That the Minister of Transportation and Communications be requested, upon the approval by the Minister of the Environment of the Environmental Assessment for the Queen Elizabeth Way Stage 2 and 3 improvement, to proceed expeditiously to resolve the capacity problems in the Skyway Corridor.

- 3 -

Comment - This is self-explanatory.

Condition (f) That the Minister of Transportation and Communications approve and give priority to the implementation of the Queen Elizabeth Way, Burlington to Hamilton, Freeway Traffic Management System prior to the construction of the Stage II improvements.

Clarification: The Q.E.W. Burlington Beach Freeway Traffic Management System is a system similar to that which is proposed for Highway 401 through Toronto. It will include incident detection, incident response, and motorist advisory information. As an example the system will provide for early detection and response to incidents (accidents, vehicle breakdowns, etc.), advance notice of whether the lift bridge is up or down, advice to motorists on traffic and road conditions and emergency diversion from the Q.E.W. to the arterial road as conditions require. The Traffic Engineering Office is directing the study and a recommended scheme is currently being reviewed. This system is proposed to be implemented as part of both the Stage 1 and Stage 2 improvements and is an integral part of the total transportation strategy for this corridor.

F. Norman,
Head, Planning and Design

FN/PA/ct

c.c.
H.F. Gilbert
L.R. Eadie
T.G. Smith
P.D. Billings
P.J. Harvey
C.R. Robertson
F. Norman
H. McNeely
J. O'Mara
P. Askie
C. Fayman
N. Sen

Copy of submission available from:

Paul Askie
Senior Project Manager
Central Region
5000 Yonge Street
Willowdale, Ont.
224- 7581

THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH

Department of Engineering
71 Main Street West, Hamilton, Ont. L8N 3T4 (416) 526-4170

82 12 20

Refer to File No T124-103
Attention of L. Franco
Your File No

Ministry of Transportation
and Communications
Traffic Management and
Engineering Office
1201 Wilson Avenue
Downsview, Ontario
M3M 1J8

Att: E. R. Mallard
Project Manager

Q.E.W./Burlington Skyway Corridor
Freeway Traffic Management System



Gentlemen:

As requested in your letter of 82 10 13 we are enclosing, herewith, a Certified Resolution endorsing your Ministry's proposal to implement a Freeway Traffic Management System.

Yours very truly,

A handwritten signature in cursive script, appearing to read "L. Franco".

for
Transport and Environment Committee

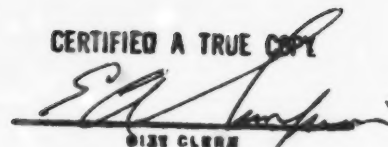
:jr
Encl.

Sub-joined is Section 6 of the First Report of the Transport and Environment Committee adopted by City Council at its meeting held December 14, 1982.

6. That Council endorse the Ministry of Transportation and Communications' proposal to implement a freeway traffic management system for the QEW/Burlington Skyway Corridor.

NOTE: The purpose of this system is to reduce the impact of the number of accidents and breakdowns of vehicles and to reduce congestion in the corridor by means of a system of monitoring devices and message signs in conjunction with the new arterial roadway and twinned Skyway Bridge.

CERTIFIED A TRUE COPY


E.A. Murphy
CITY CLERK

THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH

Department of Engineering
71 Main Street West, Hamilton, Ont. L8N 3T4 (416) 526-4170

82 11 03

Refer to File No T124-103
Attention of L. Franco
Your File No W.P. 85-81-00

Ministry of Transportation and Communications
Traffic Management and Engineering Office
1201 Wilson Avenue
Downsview, Ontario
M3M 1J8

Att: E. R. Ellard
Project Manager

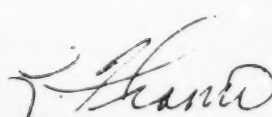
QEW/Burlington Skyway Corridor
Freeway Traffic Management System

Gentlemen:

Regional Council, at its meeting of 82 11 02, approved of the following Engineering Services Committee recommendation with respect to the above-mentioned:

"That the Regional Municipality of Hamilton-Wentworth endorse the Ministry of Transportation and Communications' proposal to implement a freeway traffic management system in the QEW/Burlington Skyway Corridor."

Yours very truly,


L. Franco
Secretary
Engineering Services Committee

/co



THE REGIONAL MUNICIPALITY OF HALTON

Report to Chairman and Members of the Planning and Public Works Committee

From R. Mohammed, Director of Planning and Development

Date 82 10 25

Report No. D.P.D. 210/82

Re: Queen Elizabeth Way Burlington Skyway Corridor Freeway Traffic Management System

RECOMMENDATION

APL
BUS. DEV.
HEALTH
LEGAL
PERSONNEL
PLANNING
P.W. <i>EBR</i>
SOC. SERV.
TREAS.

1. That the Regional Clerk notify the Ministry of Transportation and Communications that the Regional Municipality of Halton endorses the implementation of the Freeway Traffic Management System in the Skyway Corridor.
2. That the Ministry of Transportation and Communications be requested to consult with the City of Burlington and Regional Municipality of Halton on the matter of an interface between the Skyway Traffic Management System and the Burlington Traffic Signal System.

Report

On 81 10 21, Regional Council was informed (DPD 12/81) that the Ministry of Transportation and Communications was undertaking a study to determine whether the Skyway Corridor would benefit from the implementation of an electronic Freeway Traffic Management System in the Skyway Corridor. Schedule A attached to this report describes the background to this study, study objectives, description of the system and a summary of the expected benefits. The study was undertaken by IBI Limited and directed by a Steering Committee. The Region (represented by Mr. D. McCleary), the Regional Police Department and the City of

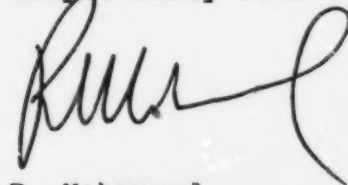
Burlington were represented on this Committee.

The cost of implementing this system is approximately 4.0 million dollars and it is expected to achieve personal time savings, fuel savings, and commercial vehicle operating time savings of 2.7 million dollars annually up to the completion of the Stage 2 Skyway Improvements. After the completion of the second Skyway, this system is expected to achieve 1.2 million dollars annually in these same cost savings. In addition, the system will increase safety, improve maintenance procedures, reduce accident rates, and reduce incidents related to partial closure during severe weather conditions.

Regional Planning and Development Staff are satisfied that this system is urgently required in this corridor as a means to assist traffic movement during the lengthy period of construction of the Stage 1, 2 and 3 Improvements in this Corridor. Also, we believe that the Ministry has adequately demonstrated the benefits of this system once the improvements in this Corridor are completed. Therefore, by way of Recommendation 1 of this report, the Ministry of Transportation and Communications is requested to implement this system. Inasmuch as this system and its operation will have an impact to some degree on the local street system, particularly during diversion situations to the new Beach Arterial Road, the Ministry, by way of Recommendation 2, is requested to consult with the City of Burlington and the Region regarding an interface between the City of Burlington Signal System and the Skyway Corridor Freeway Traffic Management System.

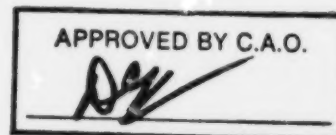
At the City of Burlington's Public Works Committee meeting of 82 11 15 at 4:30 p.m., City Hall, Burlington, representatives of the Ministry of Transportation and Communications will make a presentation regarding this proposed system and any Regional Councillors interested are invited to attend. In addition, if members of this Committee at the Region so request, arrangements could be made to have a presentation made here as well, at a later date.

Respectfully Submitted,



R. Mohammed,
Director of Planning and Development

DRM:ml





THE REGIONAL MUNICIPALITY OF HALTON

Office of the Chief
Administrative Officer

P.O. BOX 7000
1151 BRONTE ROAD
OAKVILLE, ONTARIO L6J 6E1
416/827-2151

1982 11 18

Ministry of Transportation
& Communications
Traffic Management & Engineering Office
1201 Wilson Avenue
Downsview, Ontario
M3M 1J8



Att: Mr. E. R. Ellard
Project Manager

Dear Sir:

Re: Queen Elizabeth Way Burlington Skyway Corridor
Freeway Traffic Management System

This is to advise that Council for the Regional Municipality of Halton, at its meeting of Wednesday, November 17, 1982, adopted the following resolution:

"THAT the Regional Clerk notify the Ministry of Transportation and Communications that the Regional Municipality of Halton endorses the implementation of the Freeway Traffic Management System in the Skyway Corridor.

THAT the Ministry of Transportation and Communications be requested to consult with the City of Burlington and Regional Municipality of Halton on the matter of an interface between the Skyway Traffic Management System and the Burlington Traffic Signal System."

Enclosed is a copy of staff report D. P. D. 210/82. Should you have any questions or concerns, please do not hesitate to contact the Regional Planning & Development Department.

Yours truly

F. Daruwala

F. Daruwala (Mrs.)
Assistant Recording Secretary

cc: Regional Planning & Development Department
cc: City of Burlington.

BURLINGTON

639-4540

HALTON HILLS
ACTON

853-0501

HALTON HILLS
GEORGETOWN

878-8113

MILTON

878-8113

OAKVILLE

827-2151



**The Corporation of the
City of Burlington**

November 23, 1982

City Hall:
426 Brant Street, Burlington, Ontario, Canada
Mailing Address:
P.O. Box 5013, Burlington, Ontario, Canada L7R 3Z6

Telephone: 335-7697
File No.: 86.01-1 & 82-1

Mr. E. Ellard,
Ministry of Transportation
and Communications,
5000 Yonge Street,
Downsview, Ontario
M3M 1J8



Dear Mr. Ellard:

**SUBJECT: Q.E.W./Burlington Skyway Corridor Freeway
Traffic Management System**

Please be advised that the Council of the Corporation of the City of Burlington at its regular meeting of Monday, November 22, 1982 enacted the following resolution:

"THAT the Ministry of Transportation and Communications be informed that the City of Burlington agrees with and supports the immediate implementation of the Q.E.W./Burlington Skyway Corridor Freeway Traffic Management System;

and that the Ministry of Transportation and Communications be requested to consider in detail, the possibility of an interface between the Freeway Traffic Management System and a possible future Computerized Traffic Control System in Burlington, with consideration being given to cost sharing of such a system."

Kindly forward your response in regard to the second paragraph of the resolution to Mr. M. Koevoets, Director of Public Works.

Yours truly,

Helen MacRae, M.P.A.
City Clerk and Director of
Administrative Services

al
WM/lm

cc: M. Koevoets, Director of Public Works

CITY OF BURLINGTON

REPORT NO. 297/82

82 November 02

Chairman and Members of the
Public Works Committee

Q.E.W./Burlington Skyway Corridor
Freeway Traffic Management System
File: 82.03/(82.03.30)

RECOMMENDATION:

THAT the Ministry of Transportation and Communications be informed that the City of Burlington agrees with and supports the immediate implementation of the Q.E.W./Burlington Skyway Corridor Freeway Traffic Management System;

and that the Ministry of Transportation and Communications be requested to consider in detail, the possibility of an interface between the Freeway Traffic Management System and a possible future Computerized Traffic Control System in Burlington, with consideration being given to cost sharing of such a system.

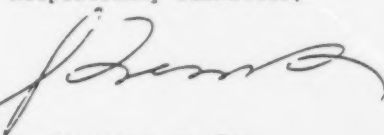
REPORT:

The Ministry of Transportation and Communications wish to proceed with the implementation of a Q.E.W./Burlington Skyway Corridor Freeway Traffic Management System. In this regard the Ministry's Consultant, Mr. Scott Stewart, Project Manager of I.B.I. Group will be in attendance at the Public Works Committee meeting to give a presentation concerning the system. Regional Council members have been invited to hear the presentation as only one presentation will be made for Burlington and Halton. Attached is a Summary Report giving details on the proposed system.

The Ministry of Transportation and Communications would like a resolution from Burlington Council indicating their support for the Traffic Management System. Burlington has been represented on the Technical Advisory Committee which was set up to study and recommend such a system. We believe that the Freeway Traffic Management System will be of major benefit to the travelling public in the area, and therefore recommend implementation.

We have discussed with the Ministry the possibility of interfacing a possible future Computerized Traffic Control System for Burlington with the Freeway Traffic Management System. The purpose of this interface would be that in the event of a major diversion of vehicle traffic from the Q.E.W. between Highway No. 2 and Fairview Street, that the City Traffic Signal System could be adjusted to assist vehicles in travelling on North Shore Boulevard and Maple Avenue as a detour route. We feel that if such an interface is desirable from the Ministry's point of view, then some discussion should take place regarding possible cost sharing.

Respectfully submitted,




M. Koevoets, P. Eng.
Director of Public Works



The Corporation of the
City of Burlington

City Hall
426 Beant Street, Burlington, Ontario, Canada
Mailing Address:
P.O. Box 5013, Burlington, Ontario, Canada L7R 3Z5

Telephone: 335-7608

File No.:

1982 July 13

Honourable Keith Norton
Minister of the Environment
135 St. Clair Avenue West - 14th Floor
TORONTO, Ontario M4V 1P5

Dear Sir:

Further to my letter of July 9, 1982 transmitting the position of our Public Works Committee on the Environmental Assessment prepared by the Ministry of Transportation and Communications for the Queen Elizabeth Way Corridor Improvements, I am pleased to enclose herewith the position of our City Council as approved at their regular meeting of July 12, 1982.

I received your extension for comments from July 9, 1982 to July 14, 1982, after having submitted the Public Works Committee's position to you, and the position as approved by City Council is substantially the same as the report which you have now received. I would highlight, however, one amendment to condition (c) that being the addition of the following words: "with particular reference to the reduction of noise levels on the present and proposed Skyway Bridge."

We appreciate you having granted the extension in order to provide us an opportunity to submit these comments with regards to the environmental assessment, and we trust that the project will now proceed expeditiously to improve the traffic conditions in our immediate vicinity.

For the purpose of clarity, I will quote the actual resolution approved by City Council, as follows:

- "2. THAT the Ministers of the Environment and Transportation and Communications be advised that the City of Burlington is satisfied with the review of the bridge versus tunnel options in the Stage II Improvements contained within the Environmental Assessment prepared by the Ministry of Transportation and Communications for the Queen Elizabeth Way, Highway 20 Hamilton to Guelph Line, Burlington, Stages II and III, E.A. File No. EA-1-82-0008000, as requested by the Council of the City of Burlington on 1981 August 14."

- "3. THAT the Minister of the Environment be requested to approve the Environmental Assessment prepared by the Ministry of Transportation and Communications for the Stage II and III improvements, Queen Elizabeth Way, Highway 20, Hamilton, to Guelph Line, Burlington, E.A. File No. EA-1-82-0008-000 with the conditions set out in the Government Review, together with or as modified by the following conditions:
- (a) That the Ministry of Transportation and Communications be requested to construct the Brant Street, Queen Elizabeth Way interchange as part of the Stage II improvements, Queen Elizabeth Way, Highway 20, Hamilton to Guelph Line, Burlington.
 - (b) That the Ministry of Transportation and Communications resolve the concerns of the City of Burlington as they relate to the diversion of the creeks due to the depressed grade of Highway 403 and the consequent need to make provision for the drainage in the recommended improvements to the Queen Elizabeth Way, Highway 20 Hamilton to Guelph Line, Burlington.
 - (c) That the Ministry of Transportation and Communications consult with the City of Burlington regarding the provision of noise barriers and landscaping within the Skyway Corridor and the movements of heavy vehicles (designated haul routes) associated with the construction of the Stage I, II and III improvements, with particular reference to the reduction of noise levels on the present and proposed Skyway Bridge.
 - (d) That the Ministry of Transportation and Communications be advised that Burlington supports the preparation of a "Design and Construction Report" and further, that they consult with the City of Burlington, Regional Municipality of Halton, Halton Region Conservation Authority and other appropriate agencies in the preparation of this document.
 - (e) That the Minister of Transportation and Communications be requested, upon the approval of the Minister of the Environment of the Environmental Assessment for the Queen Elizabeth Way Stage II and III improvement, to proceed expeditiously to resolve the capacity problems in the Skyway Corridor.
 - (f) That the Minister of Transportation and Communications approve and give priority to the implementation of the Queen Elizabeth Way, Burlington to Hamilton Freeway Traffic Management System prior to the construction of the Stage II improvements."

memorandum



To: Messrs. E. J. McCabe,
H. A. Aron,
Z. Byblow,
C. R. Robertson, Dist. #4
M. J. Halovanic,
T. G. Smith,
A. G. Kelly,
A. G. Stermac,
G. E. Boggis,
F. Norman,
P. D. Billings,
R. P. Frieday,
K. Wilson (Planning and Design)

Date: August 25, 1982



Re: Agreement - Government of Canada,
Burlington Channel Lift-Bridge

Enclosed is a photostat copy of the above Agreement for your records.

DLR:im
Encl.

Signature

Dean L. Richardson,
Regional Solicitor

P.S. As there is only one set of Contract Drawings and Documents these have been forwarded, along with executed copy of Agreement, to Head Office, Index & Registration, Information Management Office, Supply and Services Branch.

and eighty-two.

BETWEEN:

THE GOVERNMENT OF CANADA, represented by the Minister of Public Works

hereinafter referred to as "Canada"

OF THE FIRST PART;

- and -

THE GOVERNMENT OF THE PROVINCE OF ONTARIO, represented by the Minister of Transportation and Communications,

hereinafter referred to as "Ontario"

OF THE SECOND PART:

WHEREAS Ontario proposes to improve the Queen Elizabeth Way (hereinafter referred to as the "Q.E.W.") from its intersection with the King's Highway 403 in the City of Burlington, Regional Municipality of Halton, to its intersection with the King's Highway 20 in the City of Hamilton, Regional Municipality of Hamilton-Wentworth, in the Province of Ontario;

AND WHEREAS in order to carry out the above recited improvement to the Q.E.W., Ontario intends to construct a bridge similar to and parallel with the present existing bridge known as the Burlington Skyway over the Burlington Channel at the location shown on Schedule "A" attached hereto, and also subsequently to improve the present existing Burlington Skyway;

AND WHEREAS in conjunction with the construction of the above recited improvements Ontario finds it necessary to construct a four-lane roadway southerly from the intersection of the Q.E.W. with the King's Highway No. 2 to the interchange of the Q.E.W. with Burlington Street the location of which is shown on

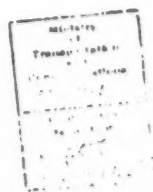


said Schedule "A", together with a traffic control system called the Highway Traffic Management System (hereinafter referred to as "HTMS");

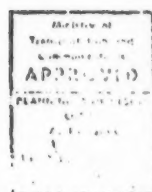
AND WHEREAS in order to carry out the construction of the above recited four-lane roadway it is necessary to modify the present lift-bridge over the Burlington Channel and the approaches thereto which are owned, operated and maintained by Canada so that the said lift-bridge may accommodate the four-lane highway facility, all as located on said Schedules "A" and "B" attached hereto.

NOW THEREFORE THIS AGREEMENT WITNESSETH that in consideration of the premises and the covenants herein contained, the Parties hereto for themselves and their respective successors and assigns agree each with the other as follows:

1. That Canada at the cost and expense of Ontario shall construct the modifications to the Burlington Channel lift-bridge (hereinafter referred to as the "lift-bridge"), including necessary equipment required for the HTMS which will be located in the lift-bridge control centre, in accordance with the designed contract drawings and documents thereof which have been prepared on behalf and at the cost of Ontario by C.C. Parker Consultants Limited, Consultant Engineers, and the services of which said company were agreed to by Canada; the said drawings and documents being identified by the signatures thereon of the signatories of the parties hereto, and true identified copies being provided to Canada before the execution and delivery hereof;
2. That with respect to the work to be done by Canada under Clause 1 herein, Canada, before awarding the contracts for the said work, shall first advise Ontario of the amount of such contracts and Ontario shall in each budget year, commencing April first, furnish Canada with a Funding Certificate or Certificates in a form acceptable by and suitable to Canada, which said Certificate or Certificates shall be completed by Ontario showing authorization of the funding for the payment of total costs of construction;



3. That Canada shall invoice Ontario monthly for the cost of the construction work done by Canada for Ontario as set out in Clause one herein, and Ontario shall pay Canada the amount or amounts so invoiced within 60 days of the receipt thereof;
4. That from the time the lift bridge is open to traffic as modified and up to the time Ontario completes the construction of the new Burlington Skyway bridge and the improvements to the present Burlington Skyway bridge, Ontario shall be responsible at its own cost to maintain and repair the asphalt driving surfaces of the Burlington lift-bridge and the approaches thereto that are within the limits of the lands owned by Canada and also for the snow removal of highway driving surfaces within the limits of the lands owned by Canada, but after such time Canada at its own cost shall resume responsibility therefor;
5. That from the time of the completion of the said four-lane roadway and the modifications to the lift-bridge to the time of the completion of the new Burlington Skyway bridge, and the improvements to the new Burlington Skyway bridge, Ontario shall be responsible to Canada for additional routine maintenance costs including the cost to repair any damage attributed by Canada to the widened deck and/or to any increase in traffic over the said lift-bridge due to the construction of the new Burlington Skyway bridge and the improvements to the present existing Burlington Skyway bridge;
6. That after completion of the four-lane roadway, of the modifications to the Lift-Bridge, of the new Burlington Skyway bridge, and of the improvements to the present Burlington Skyway Bridge and when all bridges are open to traffic, if in the opinion of Canada the bridge deck has become irreparable due to increased wear and tear, Ontario covenants to pay to Canada, within 60 days from the date of receipt of invoice, the cost of replacing the bridge deck;



7. That upon the installation of the said LMS equipment that will be located in the lift-bridge control centre, Canada will assume responsibility at its own cost for the operation thereof;
8. That upon the installation of the equipment referred to in paragraph 7 above, Ontario shall be responsible at its own cost for the maintenance of the said equipment;
9. Subject to the provisions of paragraph 6 above, that in the event it is found necessary that Canada do additional or other work, to that set out in the designed contract drawings, and documents mentioned in paragraph 1 herein, any such additional or other work, and the cost thereof, shall first be approved by Ontario;
10. That with respect to any work done by Canada for Ontario under this Agreement, it is understood and agreed upon between the Parties hereto that Ontario may at any time inspect and audit the said work;
11. Subject to the provisions of the federal Crown Liability Act and amendments Canada shall indemnify and save harmless Ontario from any claim, action, cause of action or liability, for loss, damage, accident or injury arising due to, out of, from or in connection with the negligence of Canada's contractors, officers, or servants or agents in the construction, operation and maintenance of the said lift-bridge and approaches thereto that are within the lands owned by Canada, except for damages attributable to the design modifications of the said lift-bridge and/or attributable to the maintenance of the road surface of the lift-bridge and the approaches thereto during the time Ontario is responsible for such maintenance (including snow ploughing), which shall be the responsibility of Ontario, and Ontario shall indemnify and save Canada harmless from any claim, action, cause of action liability, for loss, damage, accident or injury arising therefrom.



THIS AGREEMENT shall enure to the benefit of and be binding upon the Parties hereto and their successors and assigns.

IN WITNESS WHEREOF the Parties hereto have executed this Agreement.

SIGNED AND SEALED

AND DELIVERED

in the presence of:

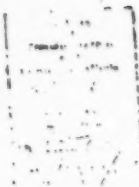
GOVERNMENT OF CANADA, represented by the
Minister of Public Works

Per

GOVERNMENT OF THE PROVINCE OF ONTARIO.

MINISTER OF TRANSPORTATION

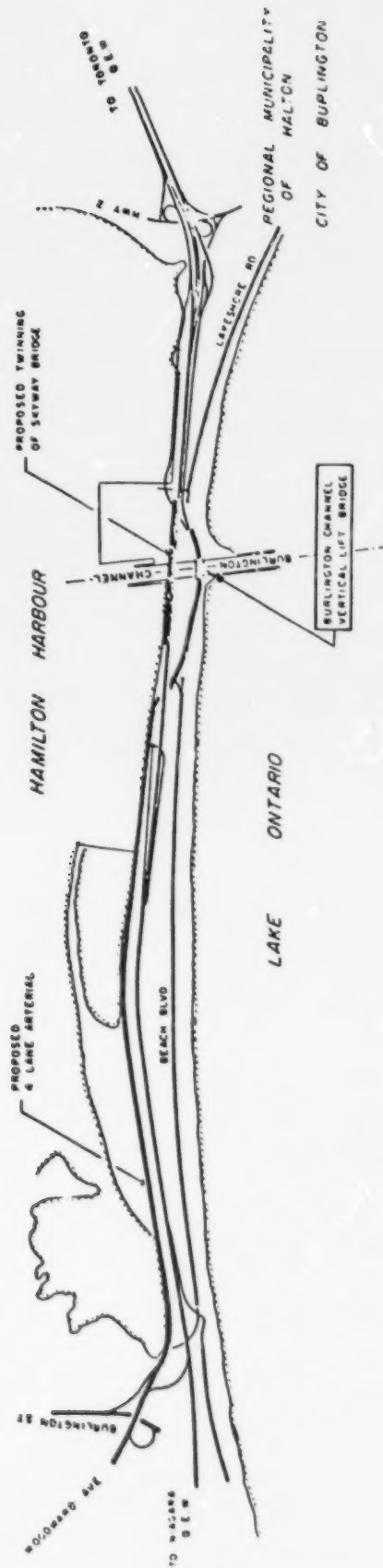
AND COMMUNICATIONS (ONTARIO)





REGIONAL MUNICIPALITY
OF HAMILTON WENTWORTH
CITY OF HAMILTON

SCHEDULE 'A'



152-7502

1. The Government of Canada
2. The Government of the Province
3. The Minister of Public Works
4. The Minister of Transportation and
5. Communications
6. The Minister of the Environment
7. The Minister of Health
8. The Minister of Education
9. The Minister of Social Services
10. The Minister of the Treasury

B E T W E E N:

THE GOVERNMENT OF CANADA
represented by the Minister
of Public Works

- and -

THE GOVERNMENT OF THE PROVINCE
OF ONTARIO, represented by the
Minister of Transportation and
Communications

A G R E E M E N T

[Handwritten signature]
152-7502

152-7502
152-7502
152-7502
152-7502
152-7502
152-7502
152-7502
152-7502
152-7502
152-7502